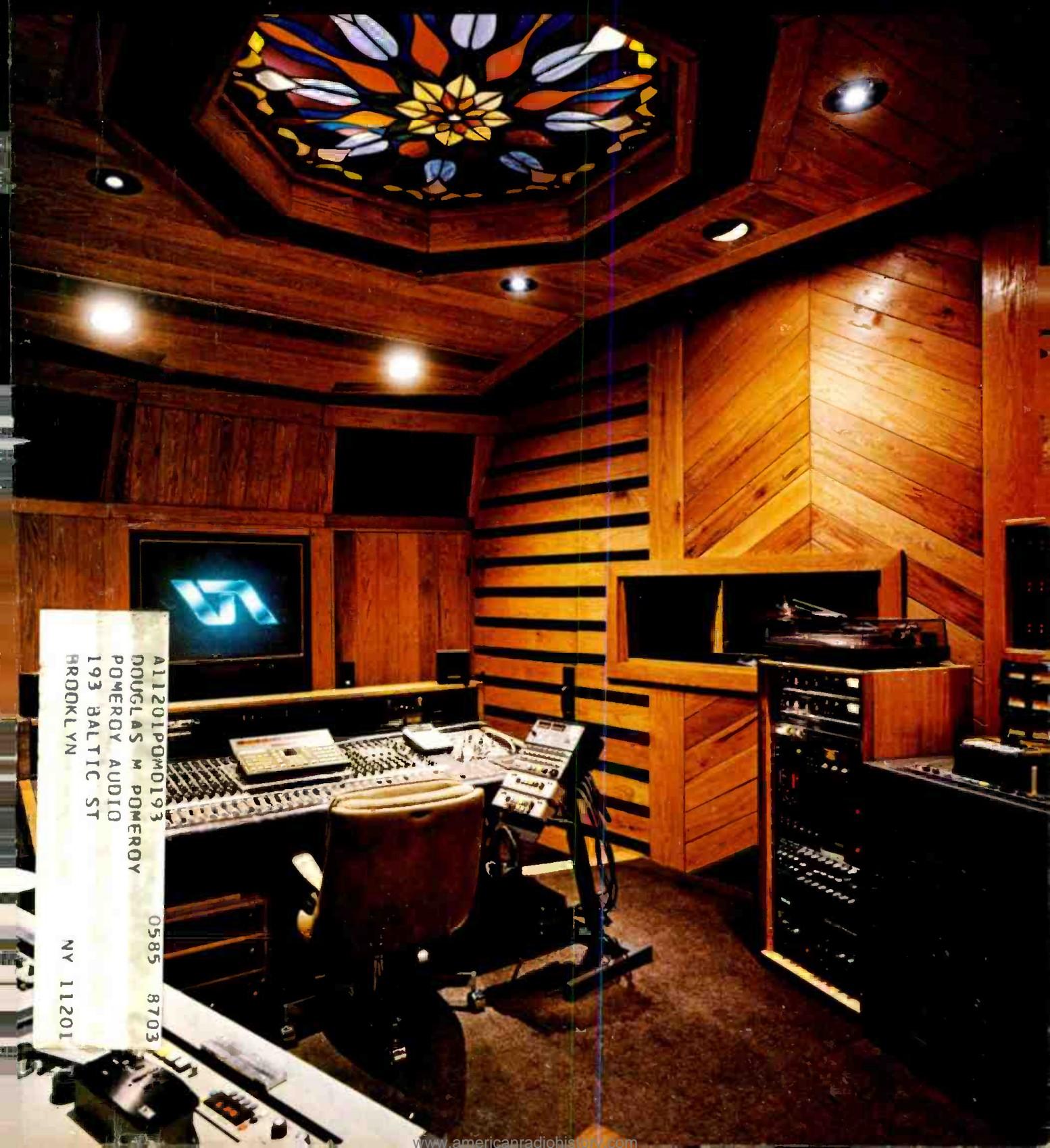


MAY/JUNE 1985
\$2.50

db

THE SOUND ENGINEERING MAGAZINE



ALL 201 POM 193 0585 8703
DOUGLAS M POMEROY
POMEROY AUDIO
193 BALTIC ST
BROOKLYN
NY 11201

If it's worth doing, it's worth doing right.



We did it right.

It's no surprise that when the key engineers of our PZM® microphone technology set their sights on combining the benefits of the boundary effect with unidirectionality, the fruits of their efforts would be nothing less than superior.

After all, Crown has been leading the way in boundary technology longer than anyone in the industry. And, like the PZM project, our commitment to developing the "premiere" unidirectional, surface-mounted microphone rings true.

Introducing the PCC™-160 Phase Coherent Cardioid™ from Crown.

Designed for easy mounting on a boundary surface, the PCC-160 utilizes a subminiature supercardioid mic capsule to create a directional pattern which improves gain-before-feedback, reduces unwanted room noise and rejects sounds from the rear.

For stage reinforcement, podiums, news desks, or for hiding in sets, the PCC-160 offers superior performance.

And because the microphone is mounted on a boundary, direct and reflected sounds arrive at the diaphragm in-phase. The result...wide, smooth frequency response free of tonal coloration or unnatural sound which can occur with conventional microphones.

Self-contained electronics eliminate the need for a sometimes awkward in-line preamp box. The PCC-160 can be powered directly from the console or other remote power source. Or if battery power is convenient, a battery supply unit can be inserted anywhere in the mike line...right up to the console or mixer.

For maximum flexibility, the

PCC-160 features an exclusive three-way "bass tilt" switch which allows you to tailor, up or down, the low-end response for special applications or unusual boundary sizes.

Due to its low profile and "go away gray" finish, the PCC-160 microphone becomes nearly invisible in use, making it ideal for the stage, newsroom or lectern top.

But beneath its cloak of dark gray, the PCC-160 is protected by a heavy-gauge, all-steel body, tough enough to stand up to even the most severe abuse.

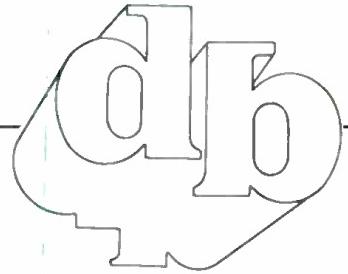
The PCC-160. A microphone meeting the needs of today's sound professional with today's most advanced technology.

We did it right.

Call or write for more information and complete specifications.



Crown International, 1718 W. Mishawaka Rd., Elkhart, IN 46517 (219) 294-8000
Circle 10 on Reader Service Card



FEATURES

Editor/Publisher
Larry Zide

Associate Publisher
Elaine Zide

European Editor
John Borwick

Associate Editor
Rita Wolcott

Technical Advisor
John Eargle

Technical Editor
Sammy Caine

National Advertising Director
Merv Katz

Advertising Coordinator/Design
Karen Cohn

Circulation Manager
Eloise Beach

Graphics
K&S Graphics

Typography
Spartan Phototype Co.

| | |
|---|----------------------|
| THE BOOM OPERATOR—THE UNSUNG HERO OF TELEVISION AUDIO | <i>Marshall King</i> |
| 20 | |
| REFLECTIONS OF AN AUDIO MAN | <i>Joel Tall</i> |
| 25 | |
| HOW TO DEAL WITH ROOM ACOUSTICS | <i>Steve Carter</i> |
| 26 | |
| MIXING FOR TELEVISION | <i>Joe Moore</i> |
| 30 | |
| TECHNICAL POSTCARDS | <i>Sammy Caine</i> |
| 32 | |
| CHEROKEE RECORDING STUDIO | <i>Sammy Caine</i> |
| 35 | |

COLUMNS

| | |
|---------------------|-----------------------|
| SOUND REINFORCEMENT | <i>John Eargle</i> |
| 6 | |
| SCENES FROM EUROPE | <i>John Borwick</i> |
| 12 | |
| DIGITAL AUDIO | <i>Barry Blessner</i> |
| 17 | |

DEPARTMENTS

| | |
|--------------------------------|--|
| LETTERS | |
| 5 | |
| NEW PRODUCTS | |
| 41 | |
| PEOPLE, PLACES, AND HAPPENINGS | |
| 45 | |
| CLASSIFIED | |
| 47 | |

db: the Sound Engineering Magazine (ISSN 0011-7145) is published monthly by Sagamore Publishing Company, Inc. Entire contents copyright © 1985 by Sagamore Publishing Co., 1120 Old Country Road, Plainview, L.I., N.Y. 11803. Telephone (516) 433-6530. db is published for those individuals and firms in professional audio-recording, broadcast, audio-visual, sound reinforcement consultants, video recording, film sound, etc. Application should be made on the subscription form in the rear of each issue. Subscriptions are \$15.00 per year (\$28.00 per year outside U.S. Possessions, \$16.00 per year Canada) in U.S. funds. Single copies are \$2.50 each. Editorial Publishing and Sales Offices: 1120 Old Country Road, Plainview, New York 11803. Controlled circulation postage paid at Plainview, NY 11803 and an additional mailing office.

YOUR WORLD



©1995 3M Co. "Scotch" is a registered trademark of 3M. Photographed at Soundworks Digital Audio/Video Studios, Ltd., NYC.

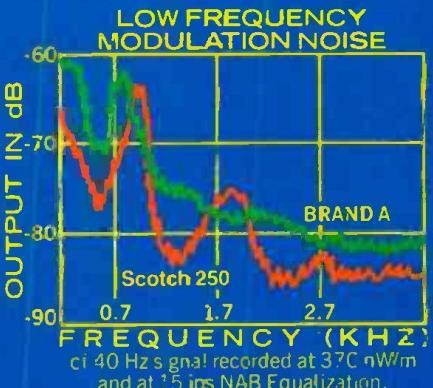


For you, it's the sixth session of the day. For them, it's the biggest session of the year. So you push yourself and your board one more time. To find the perfect mix between four singers, 14 musicians, and at least as many opinions. To get all the music you heard on to the one thing they'll keep. The tape.

We know that the tape is the one constant you have to be able to count on. So we make mastering tapes of truly world-class quality. Like Scotch 226, a mix of Scotch virtuosity and the versatility to meet your many mastering needs—music, voices, effects. And Scotch 250—with the greatest dynamic range and lowest noise of any tape, it is simply the best music mastering tape in the world.

Both offer a clearer, cleaner sound than any other tape. Getting you closer to your original source. Plus, they're both backed by our own engineers a call away. They are just two of the tapes that make us...number

one in the world of the pro.



OUR TAPE MASTERS OF CLARITY.



Scotch®
AUDIO & VIDEO TAPES

NUMBER ONE IN THE WORLD OF THE PRO

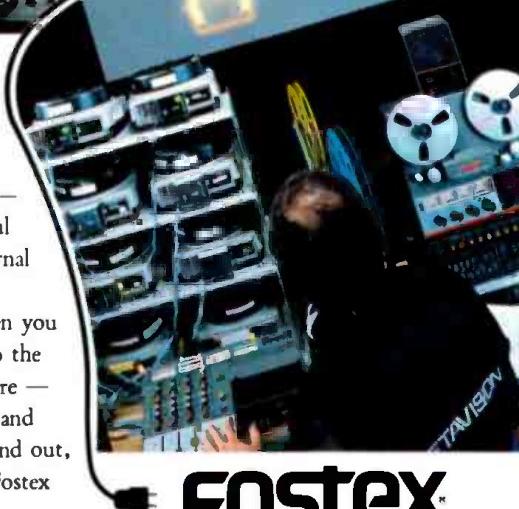
3M

Circle 13 on Reader Service Card

SELF-POWERED MONITORS FOR SELF-DRIVEN PROS



Plug right into Fostex 6301s. These compact, highly portable self-powered monitors will take any line level source — instrument, mixer, tape recorder — and give you 20 watts of powerful sound. Plus, you can use the internal amp separately for driving other speakers or even headphones, when you need that extra cue feed. Listen to the sound preferred by pros everywhere — on the road, at home, producing and presenting. Fostex 6301s. Inside and out, as dependable as a pro. At your Fostex Multitrack Dealer today.



FOSTEX

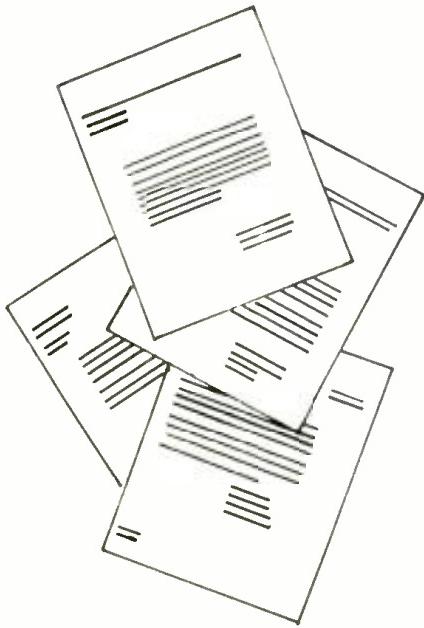
15431 Blackburn Avenue
Norwalk, CA 90650
(213) 921-1112

| | |
|----------------|-----------|
| Agfa Gevaert | Cover III |
| Amber | 37 |
| Audio-Technica | 13 |
| Cetec Gauss | 9 |
| Crown | Cover II |
| Electro-Voice | 7 |
| EAW | 6 |
| Fostex | 4 |
| Meyer | 14 |
| Nagra | 15 |
| Orban | 12 |
| Polyline | 10 |
| Shure | Cover IV |
| Studer Revox | 5 |
| 3M | 2, 3 |

About The Cover

- This month's cover features the control room of Video Tape Associates in Atlanta, Georgia. The room features an MCI-636 fully automated console with an MCI-JH-24 tape machine, a Sony 40-in. video monitor and a BTX Soft-Touch synchronizing/editing system for audio and video.

Letters



To THE EDITOR:

I always look forward to the arrival of your magazine. Multitrack recording in esoteric studios is a world apart from operating a simple FM radio station, not only in practice, but also in philosophy. However, it's still interesting to see how the "other half of the world lives."

While reviewing a recent article I was taken aback when I saw a soda container sitting on the edge of a super duper console. At most radio stations, certainly at our radio station, it is strictly forbidden to take coffee, soda, or any other beverage into the control room. Our people know that getting caught with soda in the control room would be reason to have them fired. And they know I mean it...

This was policy and procedure I learned from an excellent engineer in my younger days—Mr. Richard Kennedy, now a consultant in Detroit. Dick Kennedy taught us many things about studio operation and maintenance, and one thing was to NEVER bring beverages into the control rooms.

Thanks for your efforts.

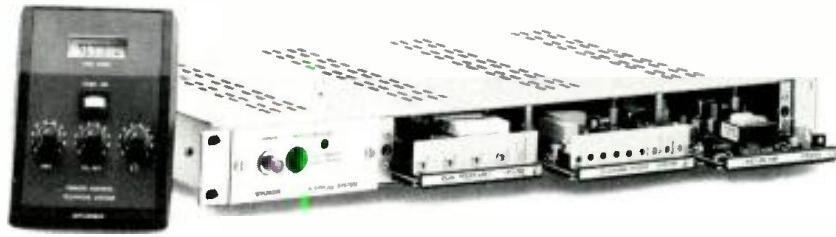
ART THOMPSON

Remember family or friends with Special Occasion, Get Well or Memorial cards.

WE'RE FIGHTING FOR YOUR LIFE

American Heart Association

Standard Setter



The Standard-Setting Telephone Interface (Modestly Improved)

It's no secret. Studer has become the acknowledged leader in high quality telephone interfacing equipment. The Studer Telephone Hybrid – already selected by hundreds of U.S. broadcasters, including all three major networks – has been praised for its straightforward design, long-term reliability, and consistently outstanding performance.

At the heart of the Studer Telephone Hybrid is an auto-balancing hybrid circuit which automatically matches phone line impedance while isolating send and receive signals for maximum sidetone attenuation. A built-in limiter prevents sudden overloads, and bandpass filters shape the voice signals for optimum clarity and system protection. The new updated Studer Hybrid includes additional noise suppression circuitry to eliminate unwanted noise and crosstalk while still preserving true 2-way hybrid operation.

Now the Studer Telephone Hybrid is also available as part of a complete Telephone System. Designed to operate independent of the studio console, the self-contained Telephone System includes a microphone input plus a palm-sized remote module (on a 30' cable) with VU meter for line level, headphone output, and level controls for microphone, headphone, and telephone receive.

The time-tested Studer interfaces. Improved for even better performance. Expanded for more flexible operation. And built to set the quality standard for years to come. Call today for the location of your nearest Studer dealer.

STUDER REVOX

Studer Revox America
1425 Elm Hill Pike • Nashville, TN 37210 • (615) 254-5651

Sound Reinforcement



**Put Together
RCF & EAW
And What Have
You Got?**



**You've Got
The Drivers That
Put You In
The Driver's Seat!**

RCF is Europe's largest manufacturer of drivers.

EAW is the U.S. manufacturer of loudspeaker systems that win prizes:

Prizes not only from organizations like Nippon Onkyo Kyokai, which named the EAW-based Unicus System "the best performing high-level sound system in the world."

But also, the even more important prize of recognition from listeners with an ear for good, clean, natural sound.

Here are some reasons for that quality:

- 1) The rigid, heavy-duty aluminum alloy frame, cast to especially tight tolerances.
- 2) The oversized 100mm (4-inch) high-temperature voice coil.
- 3) The European advanced cone and suspension design, with exceptional excursion capacity.
- 4) The massive, high coercivity ferrite magnetic structure that achieves superior flux characteristics.
- 5) And the copper shorting-ring — uniquely RCF/EAW, too — that just about eliminates third-order distortion.

And there's much more:

Component parts, for example, that are designed precisely for each driver's exact function and best performance — not designed to interchange with other units, to save money.

There's the testing: Each driver, without exception, is tested individually for centering and response linearity.

On top of that, samples of each day's production run are tested, full power, over their entire operating range for 100 hours.

And especially, there's the precision hand assembly by craftsmen who give more of themselves to the things they do than others may think worth while.

But reading isn't believing. Hearing is believing. Listen to the EAW/RCF Laboratory Series:

You'll get the message.



59 Fountain Street/ Box 111
Framingham, Massachusetts 01701
(617) 620-1478

"Hearing is Believing!"

© 1985

Circle 16 on Reader Service Card

Line Arrays and Sound Columns,

Part 1

INTRODUCTION

• While line arrays have attained relatively high status in Europe, they have not been popular in the United States for large-scale work. The commercial sound column is a relatively low-cost device, and it is often pressed into service when it should not be. Under the right circumstances, however, it represents a logical component choice.

In recent years, line arrays have grown complex, both in number and power class of drivers. These custom designs offer excellent coverage for both music and speech applications.

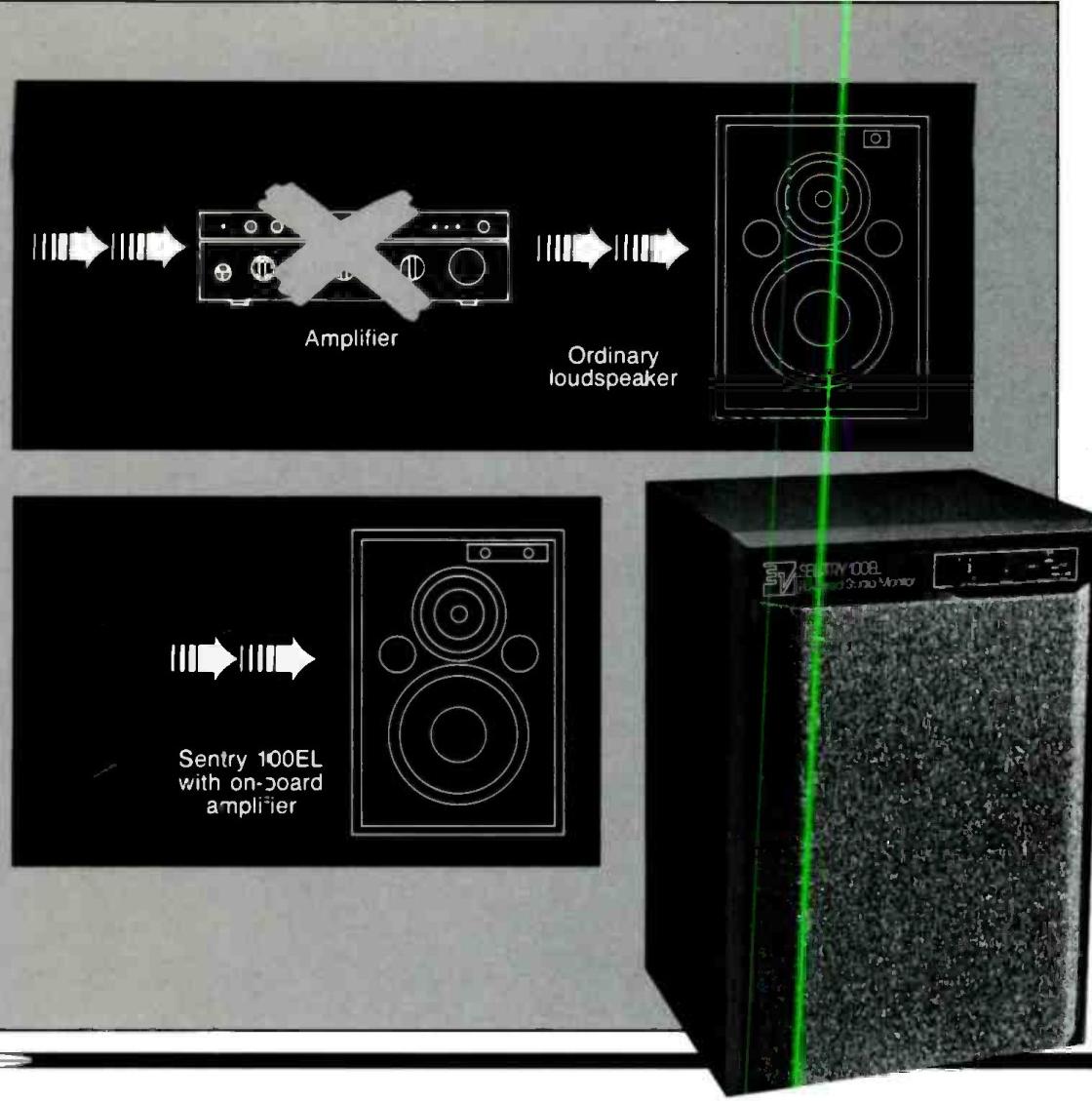
SIMPLE LINE ARRAYS

A simple vertical line array of identical components will produce a

narrowing of the coverage angle in the vertical plane, but the pattern narrowing may be no more than two or possibly three octaves wide. At higher frequencies, the pattern control becomes complex, with the generation of many lobes in the vertical pattern, with resulting erratic frequency response. In the horizontal plane, the pattern control will remain the same as for a single driver.

FREQUENCY RESPONSE TAPERING

What is required for extended high-frequency coverage is reducing the effective length of the column so that the acoustical size of the column, so to speak, is reduced with rising



Finally, a Monitor System with the Power to Make Things Easy

Imagine a monitor speaker that provides its own power. Fits in tight spaces. Simplifies setup. And reproduces sound with test-equipment accuracy.

If you can imagine all that, you've just pictured the **Sentry 100EL powered monitor system** from Electro-Voice. Designed and created for your monitoring convenience, the 100EL combines the superb audio reproduction of the Sentry 100A with an integral, 50-watt amplifier.

With speaker and amplifier in one compact, rack-mountable package, this monitor system solves problems like limited rack space, equipment transport on remotes or cramped spaces in video editing booths.

Also, by requiring less hardware—fewer cables and connectors—the 100EL keeps setup simple

and reduces potential interconnect problems. And there's no possibility of power loss caused by resistance from a lengthy speaker cable.

The on-board amplifier in the 100EL makes it ideal for single-channel monitoring. Why buy one speaker and an extra amplifier channel, when the Sentry 100EL does the job all by itself? And because amplifier power is perfectly matched to the speaker system, there's no chance of damage from inadvertent signal overload.

But convenience and trouble-free operation are only part of the package. Like all Sentry designs, the 100EL offers uncompromised accuracy. So you can be certain of quality sound.

The Sentry 100EL - with the power to make your job easier. For more information, write Greg Silsby at Electro-Voice, Inc., 600 Cecil Street, Buchanan, MI 49107.

Circle 17 on Reader Service Card

Ey **Electro-Voice®**
SOUND IN ACTION™

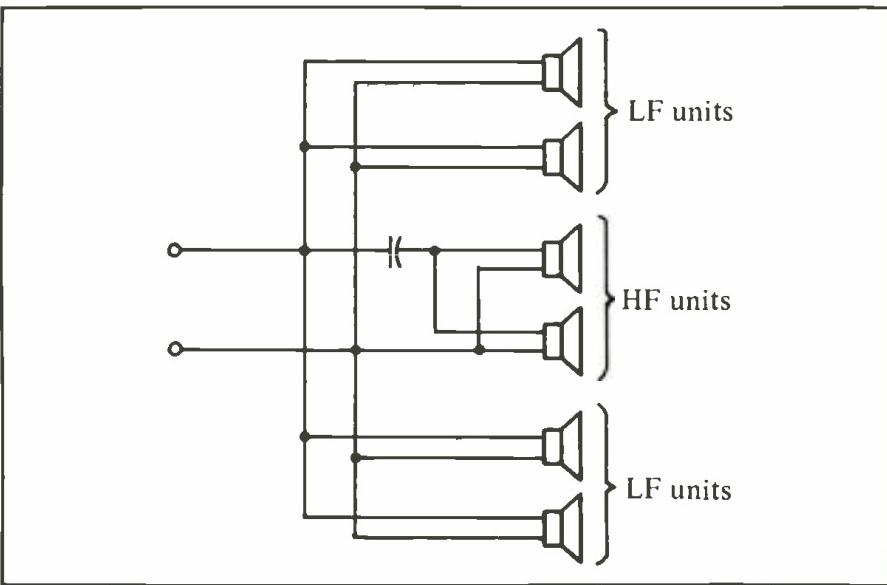


Figure 1. Column with different drivers being used with their natural high frequency roll off providing the desired tapering.

frequency. This requires rolling off the high-frequency response of the outer drivers progressively, so that at high frequencies only the innermost drivers will receive the full-range signal. When this is done, the vertical pattern control can be effectively extended.

FIGURE 1 shows how this may be done. Different driver types may be used throughout the column, so that their natural high-frequency roll-offs provide the desired tapering. Another approach is shown in FIGURE 2. Here, all of the drivers are of the same type, and frequency selective networks are used to provide the tapering.

Acoustical tapering has been used, involving fiberglass wedges to modify the response. A novel approach is the barber pole arrangement, shown in FIGURE 3. In this design, full-range drivers are used. In any given direction, the entire vertical array is operant at low frequencies, but at middle and high frequencies, the array is effectively shortened in any given direction by the natural increase in directivity for each driver. That is to say, in any given direction, only those drivers aimed in that direction will provide high-frequency coverage.

Additional improvements may be made in column performance by curving the array. This, in addition to frequency response tapering, can extend the useful frequency range of the array.

NOTES ON THE USE OF COMMERCIAL SOUND COLUMNS

Sound columns can be quite useful if a reinforcement system designer keeps in mind their inherent limitations. Here are some rules to follow:

1. Power class. Keep in mind that sound columns are usually made up of no more than eight low-cost small drivers. Power handling will be limited, and they should be used only

Did you know

...that close to where you live, free access to Government information is available on subjects ranging from starting your own business to planning a family vacation? Access to this information...and much more...is free at your Depository Library. So be better informed. Ask at your local library or write to the Federal Depository Library Program, Office of the Public Printer, Washington, DC 20401.



Federal Depository Library Program

This program is supported by The Advertising Council and is a public service of this publication

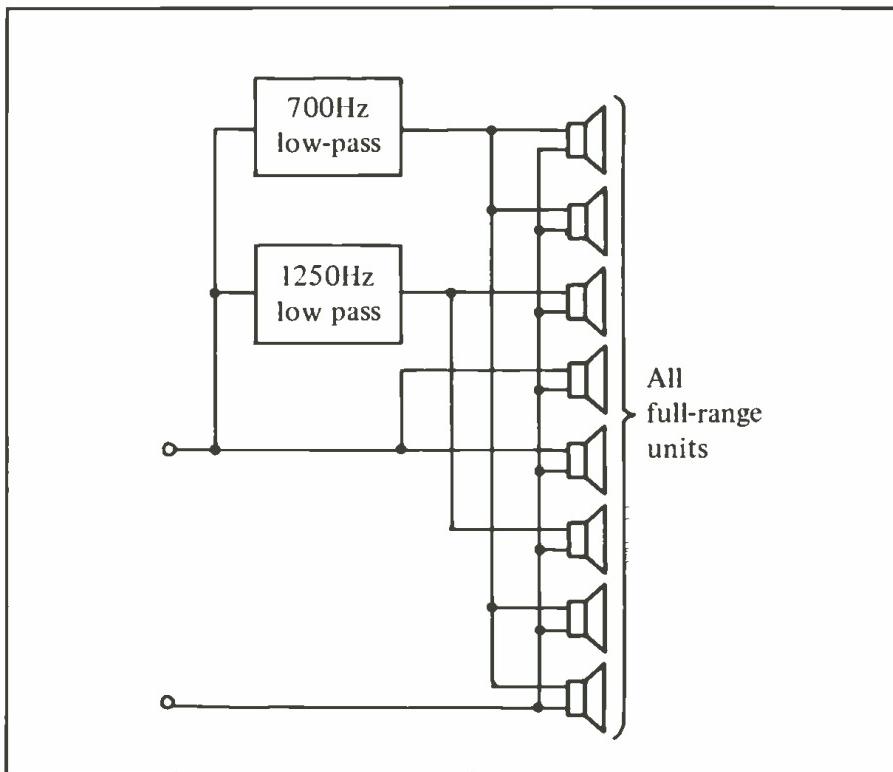


Figure 2. Frequency selective networks used to provide tapering when using drivers of the same type.

At Last, a 200 Watt Coax!

Everyone knows the benefit of a well designed coaxial loudspeaker... a single-point sound source. Until now, the most popular coaxials presented severe power limitations... had to have "trick" crossovers... and needed time compensation. Gauss technology has changed all that.

The new Gauss 3588 is the first computer designed coaxial. But, we know computers can't hear, so we used a panel of "golden ears" at the fall AES to help determine the final sound of the loudspeaker. This combination of computer design and great ears gives you a coax with the sound and the power you want!

With a conservative power rating of 200 watts RMS, this new Gauss coaxial has been tested to 750 watts delivering clean sound... and can "coast" along at control room levels still delivering great sound. Metric sensitivity is 95dB for the low frequency and 109dB HF.

Because of our proprietary design parameters, both drivers are virtually in the same acoustic plane, eliminating the need for costly time compensation networks. For bi-amp operation, you can use any standard professional quality crossover.

The unique cosh horn was designed using

Gauss's exclusive Computer Aided Time Spectrometry (CATS™) program. This design provides an extremely stable image... reduced second harmonic distortion... and virtually no midrange shadowing.

For additional information on the new Gauss coaxial loudspeaker, call or write Cetec Gauss, 9130 Glenoaks Blvd., Sun Valley, CA 91352, (213) 875-1900. Or better yet, hear it at a selected sound specialist soon.

Sound Ideas for
Tomorrow... Today!
gauss
by Cetec



Circle 18 on Reader Service Card

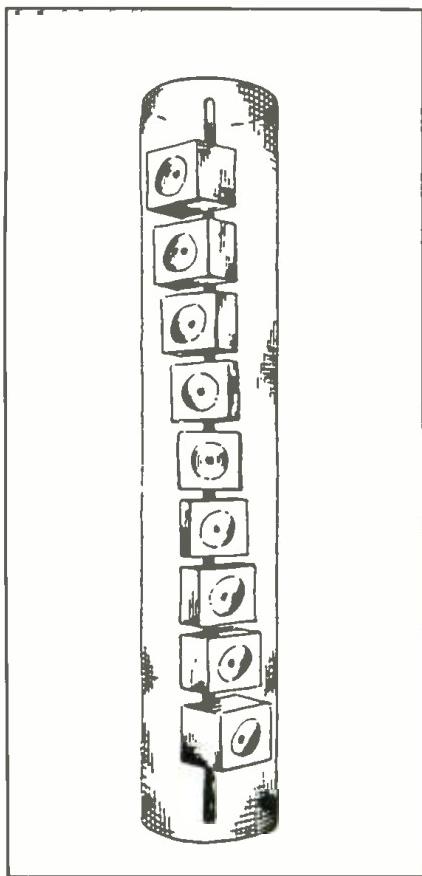


Figure 3. "Barber Pole" configuration
(by permission of AES Journal).

POLYSET
Audio
Cassettes

PROFESSIONAL QUALITY
in 46 Stock Lengths
C-02 thru C-92
In One Minute Per Side
Increments

POLYSET DIV.
of
Polyline Corp.
1233 Rand Road
Des Plaines, IL 60016
(312) 298-3073

10 db May-June 1985

Circle 19 on Reader Service Card

for speech applications where demands below 150 Hz are minimal.

2. Grazing incidence preferred. Sound columns may be used in spaces where the horizontal coverage distance is up to six or eight times the column's height above the listening plane. In these cases, the sound column should be aimed straight back so that vertical off-axis characteristics tend to complement inverse square fall-off.

3. Adjuncts in a distributed, delayed system. While ceiling mounted drivers are required for distributed systems in rooms with relatively low ceilings, houses of worship will require auxiliary loudspeakers mounted to the sides. For these applications, sound columns will represent the best choice, since coverage can be aimed where needed.

4. Gain considerations. If sound columns are used in fairly small

HORIZONTAL LINE ARRAYS

A special application of the line array is shown in FIGURE 4. The space is rectangular, and a line array has been placed over the proscenium from wall to wall. No electrical tapering has been used. There are reflected images of the array in both side walls, and the line array becomes in effect an infinite one. As a result, the listener at any point in the room perceives the source of sound as localized directly ahead, since that will always be the direction of the first arrival sound.

Such a system, designed by Klepper Marshall King Associates, has been installed in the concert hall of the Peabody Conservatory in Baltimore, and consists of more than fifty 200 mm (8 in) loudspeakers. The attenuation of direct sound away from this array is 3 dB per doubling of distance, and there exists through-

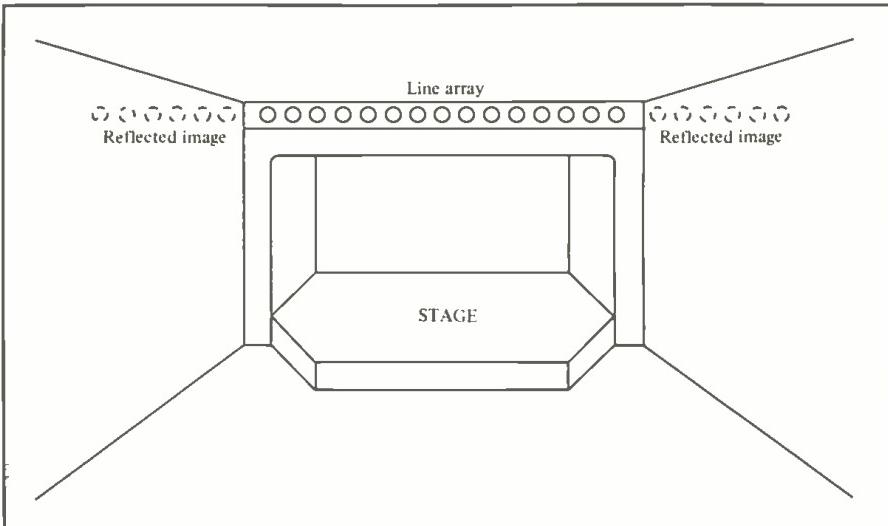


Figure 4. Horizontal Line Array.

spaces, place the column away from the microphone in order to minimize feedback. If the podium is located on the left, then place the column on the right. While this may not produce the most natural effect, it is preferable to feedback which may result if the column is too close to the microphone. The use of directional microphones and fairly close placement to the talker is recommended.

5. When possible, choose sound columns with as large and as many components as possible. The larger models will exhibit controlled vertical coverage over a wide frequency range with minimal lobing. Horizontal response will be relatively wide at all frequencies.

out the hall a favorable balance of direct to reverberant sound. The system is unobtrusive and is intended for speech applications. This approach is of course limited to single-channel, or monophonic, application. ■

RECOMMENDED READING

1. G. Augspurger and J. Brawley, "An Improved Colinear Array," presented at the Audio Engineering Society Convention, New York, 8-12 October 1983; preprint number 2047.
2. D. Klepper and D. Steele, "Constant Directional Characteristics from a Line Source Array," Journal Audio Engineering Society, Vol. 11, Number 3 (1963).

MICROPHONES!

At long last, all the questions you ever asked...all the problems you ever grappled with...are answered clearly and definitively!

The Microphone Handbook

In 256 fact-filled pages, liberally sprinkled with over 500 illuminating photographs, drawings and diagrams, John Eargle covers virtually every practical aspect of microphone design and usage.

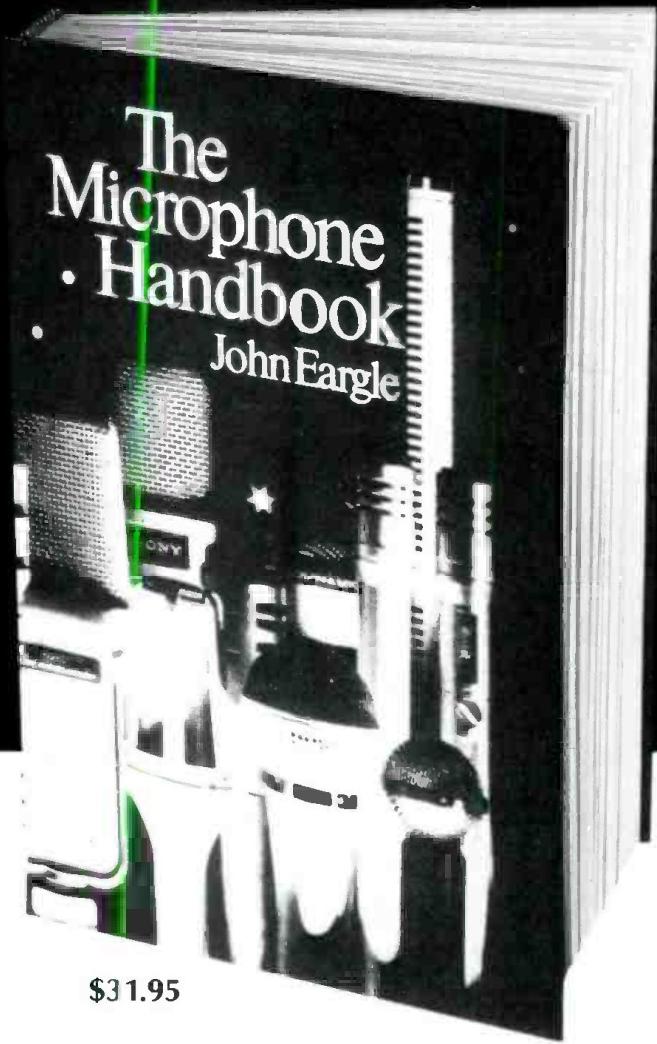
Completely up to date, this vital new handbook is a must for any professional whose work involves microphones. Here are just a few of the topics that are thoroughly covered:

- Directional characteristics—the basic patterns.
- Using patterns effectively.
- Microphone sensitivity ratings.
- Remote powering of capacitors.
- Proximity and distance effects.
- Multi-microphone interference problems.
- Stereo microphone techniques.
- Speech and music reinforcement.
- Studio microphone techniques.
- Microphone accessories.
- And much, much more!

THE MICROPHONE HANDBOOK. You'll find yourself reaching for it every time a new or unusual problem crops up. Order your copy now!

JOHN EARGLE.

noted author, lecturer and audio expert, is vice-president, market planning for James B. Lansing Sound. He has also served as chief engineer with Mercury Records, and is a member of SMPTE, IEEE and AES, for which he served as president in 1974-75. Listed in *Engineers of Distinction*, he has over 30 published articles and record reviews to his credit, and is the author of another important book, *Sound Recording*.



\$31.95

ELAR PUBLISHING CO., INC.

1120 Old Country Road, Plainview, NY 11803

Yes! Please send _____ copies of **The Microphone Handbook** @ \$31.95 per copy. (New York State residents add appropriate sales tax.)

Payment enclosed.
Or charge my MasterCard Visa

Acct. # _____ Exp. Date _____

Name _____
(please print)

Address _____

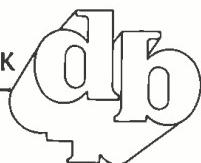
City _____

State/Zip _____

Signature _____

Outside U.S.A. add \$2.00 for postage. Checks must be in U.S. funds drawn on a U.S. bank.

If you aren't completely satisfied, you may return your copy in good condition within 15 days for full refund or credit.



A Soundcraft Celebration

• As I parked my car outside the new Soundcraft factory at Borehamwood just north of London on Friday, April 26th, I could already hear the sounds of some kind of party in progress. Sure enough, as I was handed a glass of champagne and a warm welcome by Phil Dudderidge (Chairman and Marketing Director) and Graham Blyth (Technical Director), I learned that we were celebrating several Soundcraft successes at once.

First, the company had just been listed a few days before in the annual Queen's Awards to Industry. This prestigious Award is for noteworthy achievements in design or marketing, and this Soundcraft Award was particularly for Export Achievement. (They were also granted a Queen's Award in 1979, the first ever to a professional audio manufacturer.)

Second, the continued year-by-year expansion of exports which this latest Award recognised was in itself

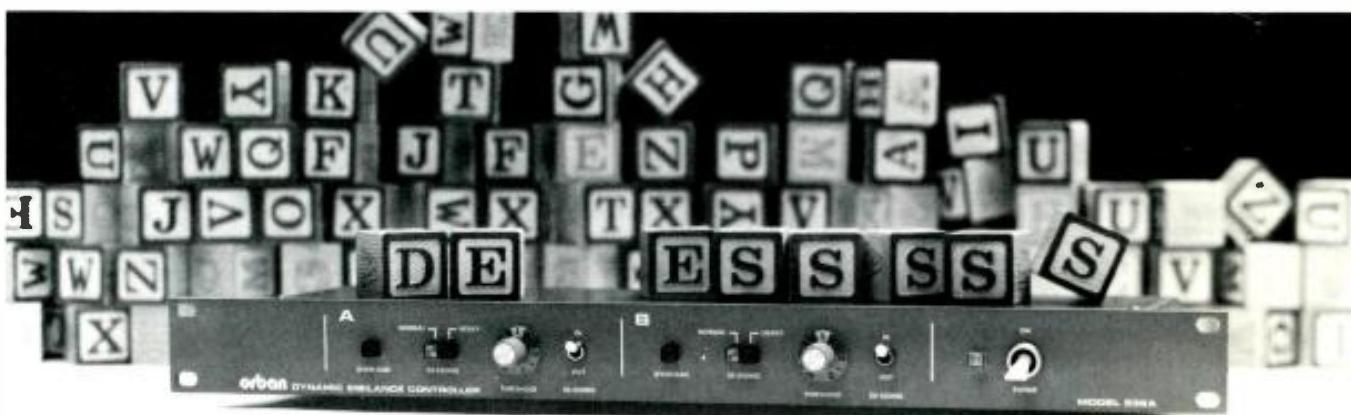
a matter for celebration. During 1984 Soundcraft exported a stupendous £5.6 million in professional consoles and recorders, representing nearly 90% of its total turnover of £6.5 million. This meant that they accounted for 2% of Britain's entire dispatch of high-technology electronics to world markets. All this export business has been helped by the setting up of a wholly-owned subsidiary company Soundcraft Electronics in the US with offices in Los Angeles and New York, joint-venture subsidiaries in Japan and Canada, and the successful placement of contract orders in such countries as Australia, Singapore, Hong Kong, South Africa and even the People's Republic of China.

NEW AUTOMATED FACTORY

But the third and most important cause for celebration that day was the official opening of Soundcraft's new

£750,000 automated factory—for which the local Mayor was on hand to cut the tape, resplendent in Mayoral gold chain. While Soundcraft's main offices remain at their London address in Great Sutton Street, employing 35 people of whom 15 are engaged in Research and Development, this new factory represents a very large expansion in terms of manufacturing capability.

The 35,000 sq. ft. site is convenient for both Heathrow Airport and Central London and employs 120 people. The use of computer-controlled automatic production machinery has been taken to the ultimate, and includes the latest automatic test equipment. I was lucky enough to be given a solo tour of the plant guided by Graham Blyth (while Phil Dudderidge and his team entertained the mayor and their guests from the press and from many major recording studios in London and elsewhere).



The ABC's of de-essing.

You know they're out there—those nasty "S" sounds that stymie the pursuit for quality in your vocal productions. That's why we've perfected our 536A Dynamic Sibilance Controller which subtly and effectively controls harsh "S" sounds while you mind your P's and Q's.

The 536A is a single purpose, two-channel de-esser which allows your vocal tracks to have the presence and sparkle you demand without the abrasive, distracting sibilance which can be an unexpected by-product. The 536A also allows for constant de-essing regardless of changes in input levels.

Listen and discover why some of the world's greatest producers and engineers rely on the Orban 536A De-Esser to give them a bright, up-front vocal sound, without excessive sibilance.

orban

Orban Associates Inc. 645 Bryant St.
San Francisco, CA 94107 (415) 957-1067
Telex: 17-1480

Circle 20 on Reader Service Card

The assembly area was larger than in any other professional console plant I have visited, but its logical layout made everything easy to follow. For one thing, the availability of all that lovely space meant that the separate labelled lines for each specific console model could be kept well apart from neighbouring lines. The most impressive evidence of automation could be found in the assembly line for printed circuit boards which runs all along one side of the plant.

This important early stage in manufacture was previously subcontracted out, when Soundcraft assembled all their consoles in the cramped London premises. Their new PCB line is just part of Soundcraft's ambitious changeover to Production Engineering and will speed everything up, enabling them to change manufacturing plans in two or three weeks rather than months. It all begins with an electronic octopus (actually a £250,000 Fuji automatic PCB assembly machine) which selects and inserts all the small components into the boards at a fantastic speed, and is scheduled to produce 3,500 boards per week.

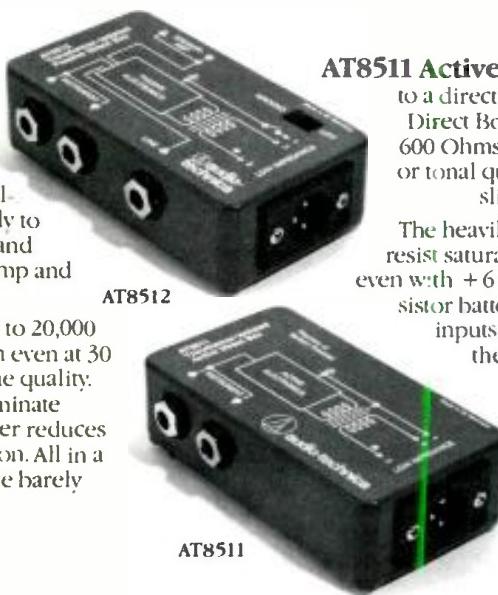


A portion of the automated PCB assembly line at Soundcraft's new Borehamwood factory.

AT8512 Passive Direct Box

Box It doesn't just lie there. The AT8512 can take your instrument output, or amp line out, or speaker power, match it for impedance, power and voltage, and send it as a balanced microphone-level signal directly to the mixing board. Paired instrument and speaker jacks permit using both the amp and the direct box at the same time.

The high-grade transformer passes 30 to 20,000 Hz ± 1 dB with less than 1% distortion even at 30 Hz. Clean, clear, with no change in tone quality. A ground lift switch is included to eliminate ground loop hums, and the transformer reduces shock hazard with up to 2500V isolation. All in a heavily-shielded, tough aluminum case barely larger than a pack of cigarettes.



AT8511 Active Direct Box

Not all instruments react kindly to a direct feed to a mixing board. Enter the AT8511 Active Direct Box. It balances an unbalanced line, converts it to 600 Ohms and sends it on its way with no change in level or tonal quality. And it doesn't affect the instrument in the slightest. No loading down, no losses of any kind.

The heavily-shielded transformer is specially designed to resist saturation, while delivering 20 to 20,000 Hz ± 0.2 dB even with +6 dBm input. Power comes from a single 9V transistor battery or external 24-48V phantom power. Parallel

inputs permit you to use your amp while also feeding the mixing console direct. The die-cast aluminum case protects your investment.

Either way, either one, an Audio-Technica direct box improves your sound on stage and in the studio. Tuck one or both in your accessory kit today. At your Audio-Technica dealer now.

Anything in... Everything out!

Two new direct boxes from



audio-technica®

Audio-Technica U.S., Inc., 1221 Commerce Dr., Stow, OH 44224
(216) 686-2600

Circle 21 on Reader Service Card

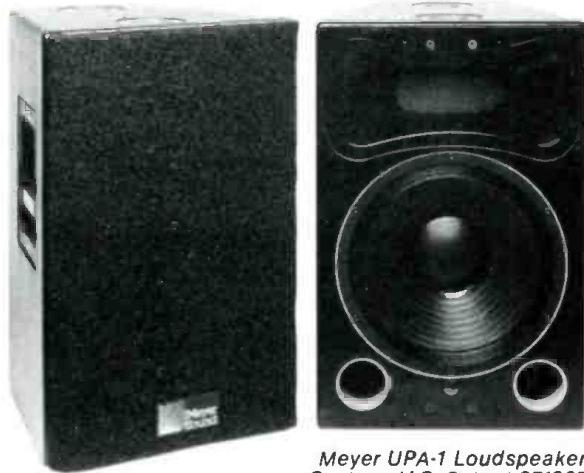


Console production underway at the spacious Borehamwood factory.

These can be handled as single boards or as mother/biscuit board groupings up to 500 by 400mm in area. The Fuji inserts axial and radial wired components (including 7-lead items) at a rate of up to one component every 0.75 seconds. A maximum of 36 cartridge feeds can be handled with automatic on and off transportation.

The boards are then conveyor-fed to manual assembly positions where the larger or more tricky components are added, and then on to a comprehensive Electrovert flow solder machine. Flux is applied to the boards by a foaming process, then they are pre-heated via infra-red before having their undersides flow soldered by the widely used wave method. Finally, each board visits the Zehntel computer test machine where component verification and other checks are made using the Zehntel diagnostic facility for faulty boards. Graham Blyth proudly showed me at the beginning of the line how each PCB has a bar-line label stuck on which identifies it for evermore (so much better than the old loose piece of paper or card). A computer record can then be kept of the automatic test result, so that any

LESS THAN ONE PERCENT FAILURE!



Meyer UPA-1 Loudspeaker
System, U.S. Patent 271967

We were pleased, but not surprised, when our distributors and dealers told us that buyers of Meyer Sound equipment reported **less than a one percent failure rate** in the new gear they purchased.*

At Meyer Sound we take extraordinary precautions to ensure that **all** the components used in our systems are of the highest quality obtainable. All the parts in each piece of Meyer equipment are **100 percent tested** to guarantee reliability and consistent performance. Each assembled unit is thoroughly tested again before leaving our factory.

At Meyer Sound reliability isn't just a word to sell loudspeakers—it's the philosophy on which our reputation is built. If you've heard about Meyer, but you haven't *heard* Meyer, call or write us. We'll give you the name of a dealer who can arrange a demonstration.

*Figure includes warranty and non-warranty repairs on an annual basis.



Meyer Sound Laboratories
2832 San Pablo Avenue
Berkeley, CA 94702
(415) 486-1166

Circle 22 on Reader Service Card

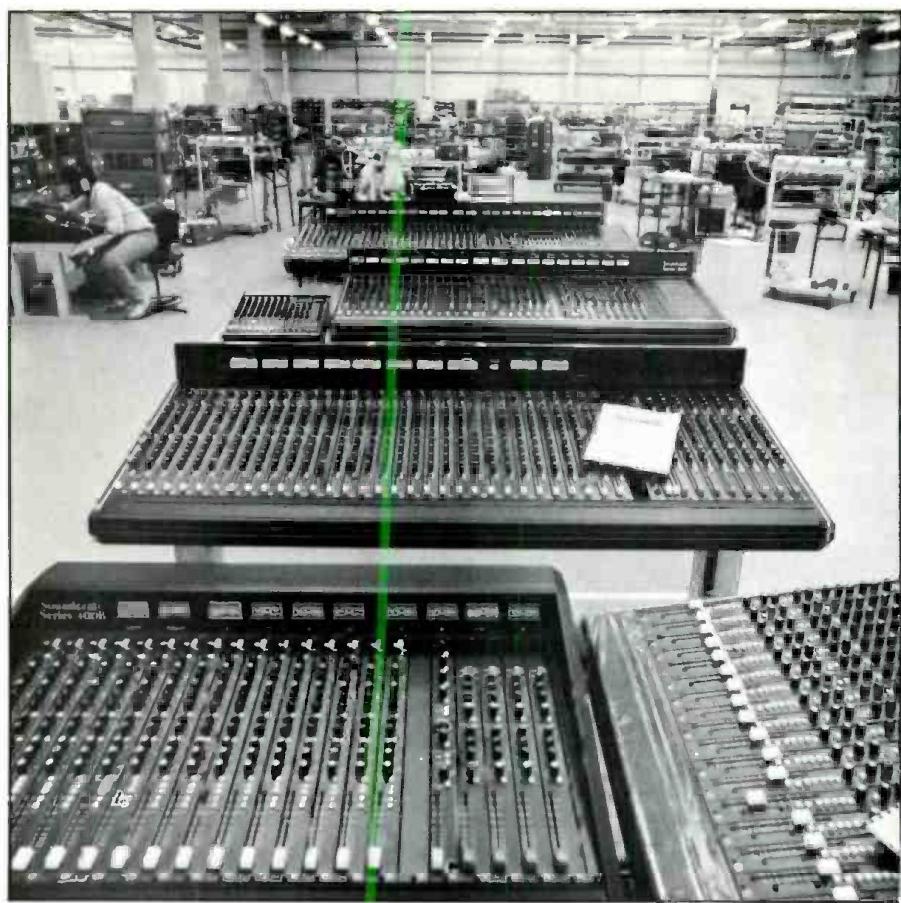
faulty board can be speedily repaired.

Other manual pre-assembly stations were busy making metal subframes and circuit modules.

EXPANDED PRODUCT RANGE

The separate assembly lines already mentioned confirmed the wide range of models now being marketed by Soundcraft, as well as their recent diversification into such areas as high-speed cassette duplication systems, amplifiers and of course their multitrack tape recorders (still built at their Soundcraft Magnetics subsidiary in Wood Green, London, the second largest European manufacturer of multitrack recorders).

Pride of factory was taken by the TS24, an in-line console which was launched last year and is Graham Blyth's most sophisticated design to date. User feedback became a much-appreciated feature of the TS24's early evolution through installing the first prototype in Berry Street Studios, just next door to the Soundcraft London R & D department. For example, use on busy session work soon identified the original one-piece patch bay as too difficult to access, so that a modular construction was substituted. Berry Street Studio



A small portion of Soundcraft's finished products at the new Borehamwood facility.

NAGRA IV-S TC

Post another advance in recording technology for NAGRA! The new NAGRA IV-S TC incorporates unique Time Code circuitry which permits time code record/playback (via switch selection) of the five film or video SMPTE/EBU standards.

What's more, there's an eleven key, slide-out, mini keyboard to enter or read data and check system operation, plus a seven segment eight digit LCD readout.

Of course, the recording quality, the functionality, are what you've come to expect from NAGRA . . . just this side of perfect

KUDELSKI S.A. CH-1023 Cheseaux / Switzerland phone (021) 91.21.21
USA Nagra Magnetic Recorders Inc. (212) 840.09.99 New York and (213) 469.63.91 Hollywood
U.K. Hayden Labs. (753) 88.84.47 Chalfont St. Peter
F.R.G. Nagra Kudelski gmbh (089) 65.66.33 München
Italy Nagra Italia srl (06) 591.09.52 Roma
France Nagra-France (1) 271.53.52 Paris

NAGRA KUDELSKI
a passion for perfection



Technician checking finished product at Borehamwood plant.

HAVE A RECORDING STUDIO PROBLEM?

Call DataLine

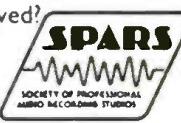
(213) 651-4944

The Society of Professional Audio Recording Studios, a non-profit organization, offers SPARS members, and non-members referred by a SPARS member, a national telephone 'hot-line.'

Questions regarding any area of

recording studio operations including business practices, audio engineering, and technical maintenance will be answered by SPARS-approved sources at no charge.

Want a problem solved?
Call SPARS—
(213) 651-4944



SPARS Board of Directors and Consultants

Murray R. Allen
Universal Recording Corporation Chicago
Jerry Barnes
United Western Studios Los Angeles
Charles Benisty
Soundwave Digital Audio Video Studios New York

Larry Boden
JVC Cutting Center Los Angeles
Bruce Botnick
Digital Magneplex Los Angeles
Nick Colleran
Alpha Audio Richmond

Mack Emerman
Criteria Recording Miami
Bob Lefkin
Regent Sound New York
Lenard Pearlman
Talent Chicago
John Rosen
Tanto Professional Services Nashville

Christopher Stone
Record Plant Inc Los Angeles
Joseph D. Tarsia
Sigma Sound Studios Philadelphia
David Teig
New York
John Woram
Woram Audio Associates New York

engineers now have the same production model as is being supplied to other major studios, and are continuing to be a source of helpful comment. Some important new clients for the TS24 include Advison, Nova Sound Studios, Clock Studios, Pete Bellotte, Oasis Recording Studio in North Hollywood, Warner Brothers in Nashville, Sound Unreel in Memphis, Custom Sound in Shreveport, LA, and others in Norway, Italy, Switzerland, Sweden, Spain and France.

I also saw Soundcraft's new Series 500 and Series 600 consoles coming off their production lines. The Series 500 is designed for live assignment work and has flexible visual and audible monitoring of sub-groups, input modules (e.g. an 8-track tape recorder) etc. The Series 600 is aimed at 16-track studios using anything from a Fostex VB16 up to Soundcraft's own Series 760/16 recorder.

As an example of the increased output made possible in the new automated factory, I was told that Soundcraft currently supply about 250 of their popular Series 200 consoles a month: Manual assembly could produce the modules for this at a rate of about one per hour, but automation has boosted this to 40 per hour.

FROM SMALL BEGINNINGS

Cause for celebration indeed, and Soundcraft has certainly come a long way in its 11 years of existence. Readers of dB Magazine may remember their humble beginnings back in 1973. The two founders were still in their early twenties but combined their respective skills as electronics engineer (Graham Blyth) and sound mixing engineer (Phil Dudderidge) to creating small stage mixers in a music-shop attic in London's Tottenham Court Road.

"Touring sound" has been a specialty of Soundcraft since these early days of their Series 1 and Series 2 road consoles. But they have now extended their range so successfully—particularly in the up-market, broadcast and TV directions—that they now claim to offer the broadest spectrum of consoles from any single manufacturer. Computer Aided Design (CAD), Computer Aided Mixing, as in the TS24 package—and now Computer Aided Manufacturing in this impressive new factory—hold out the promise of a steady flow of innovative products from one of Britain's most enthusiastic professional companies.



RFI and Audio

• There was a time when RF meant that an audio signal was going to be sent to a transmitter for broadcast distribution. Only real transmitters produced radio frequencies. Audio frequencies were two orders of magnitude lower in frequency. In a building with an RF transmitter, one sometimes had to deal with problems of RFI (radio frequency interference). The large radiated power meant that the building contained electric and magnetic fields of high intensity. Interference could sometimes be observed because of non-linearities in audio connections. If we examine a solder joint which is poorly made, we observe that it has a slight non-linearity, much like a point-contact diode. This non-linearity could demodulate the AM modulation on the RF and result in audio. Many of us observed this on the input stage of a phono-preamplifier. And some people had demodulation in their teeth fillings.

To minimize such problems, RF traps were sometimes placed in the studio at the inputs to low level

stages. Special forms of room shielding were sometimes also used. The typical studio environment did not have such problems unless there was an RF transmitter very close. Since radio broadcasting has become only a matter of playing pre-recorded music, and since recording studios have become a separate institution, the concept of RFI all but disappeared as an engineering activity.

THE NEW RF

Now in the 1980s RF has returned to the studio in a primitive and brutal fashion. RFI is again an issue but most engineers, especially audio engineers, do not even know what the letters mean. There are two new sources of RF: the computer and digital audio. In the bad old days RF was any frequency above 100 kHz. Today, we build home computers and digital audio equipment which uses internal clocks of 20 MHz. These frequencies are not sinewave but rather square waves. We must then consider all of the harmonics. This

brings us to the 200 MHz region.

To those of us who have forgotten our college courses, or never took them, it is difficult to understand what RF really means in the practical sense. Like audio it still follows the basic laws of physics. The game does change however. Audio is like DC in the sense that the wavelength is extremely large. If we charge a plate at a 30 kHz rate we will create an electric field. The wavelength of this field will be 10,000 meters. In other words, the entire room will have the same electric field at a given time.

Now consider the same situation but at 300 MHz. The wavelength is only one meter. Different parts of the room have a different field structure. In fact, the detail behavior is more like a radiating wave rather than a static field. This is only one of the small differences which we observe. Another difference is that these high frequencies can travel in air much easier than low frequencies which need wires! Hence, we often describe RF as crawling around through the

cracks. Components change their nature. A nice capacitor of 100 nF at audio frequencies becomes an open circuit at 300 MHz. The reason is that the internal construction is such that the intrinsic inductance is so large relative to the capacitance that it dominates it. An RF designer will describe how easy it is to make an inductor, but how difficult it is to make a capacitor! This is the reverse of audio.

Problems with RF are general though to be issues for equipment with RF sensitivity. The FCC recently recognized the larger issues by requiring manufacturers to pass specific tests showing that their equipment does not radiate RF which might interfere with other radios and televisions. There were two tolerances: a tighter one for the home environment and a weaker one for commercial and industrial usage.

You may wonder why we have concerned ourselves with RF in an audio studio. The answer is that these new RF fields can become large and they can degrade audio equipment. Moreover, the sources of the fields are not a transmitter but are the actual audio equipment themselves.

A CASE STUDY

I would like to tell you a real story involving the RFI problems of digital audio equipment. Several years ago, I was involved with the design of a large digital audio system using ultra-high quality A/D and D/A converters which were connected to a large computer-like digital processor with disks, consoles, and other equipment of that nature. The project was so large that different people worked on different parts until the final interconnection. I was involved in the design of the A/D and D/A part, which itself was rather large.

I did the design very carefully and we built the analog subsystem using all good practice. It was constructed and tested by itself, demonstrating good performance numbers. We took the usual concerns for grounding with a solid ground plane on each card; and a good copper backplane. The cage was solid metal and well closed. There was even an RF trap on the power supply. I was concerned that RF would enter the analog system to produce degradation internally. The sampling process is a form of demodulation and any RF at

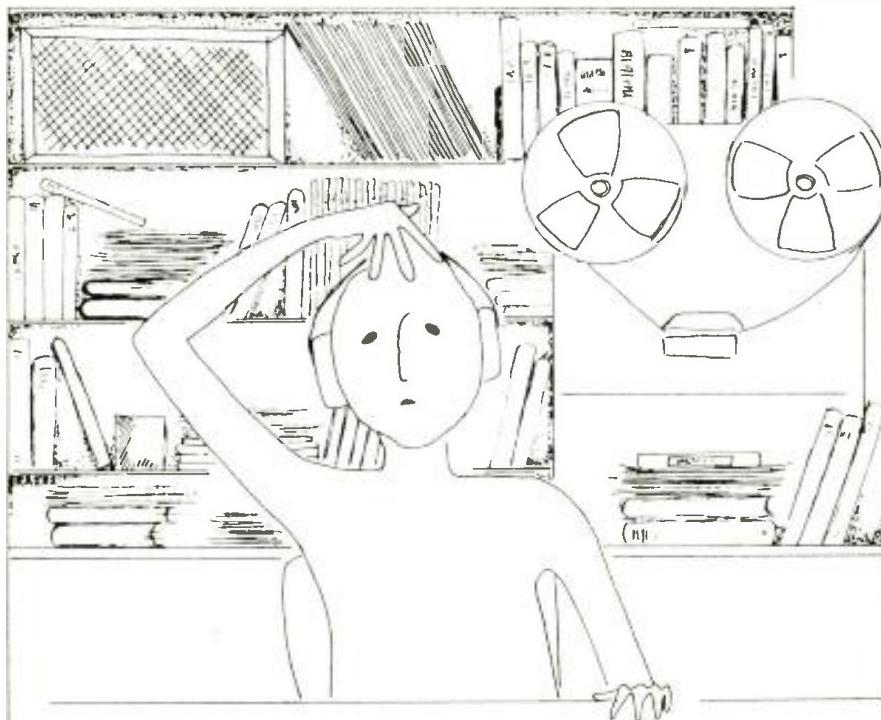
this point would also be demodulated. I was also interested in preventing any RF from leaving the box to influence other equipment, such as mixing with the bias frequency of an analog tape recorder.

Everything tested well and we interconnected the digital system to the analog system. Suddenly the analog measurements did not appear to be as good. To really understand the problem you have to realize that there was a digital cable of about 80 signals connecting the digital subsystem to the analog subsystem. Each of these signals was a high speed digital signal with spectral content to 300 MHz. Moreover, and more importantly, the grounds for these signals connected the ground of the analog subsystem to the main computer ground.

The test of the system showed that for harmonic distortion there was a severe reduction in performance. The noise measured OK, but not distortion.

Ordinarily, we would not think of RF as being a problem for distortion. Using a good quality distortion analyzer we were able to observe random notches in the signal which

DO YOU KNOW WHERE?



Have you mis placed your db again? Our high quality, royal blue vinyl binders keep 12 copies of db neat and handy for ready reference.

Just \$9.95, available in North America only. (Payable in U.S. currency drawn on U.S. banks.) ORDER YOURS NOW!!

Sagamore Publishing Co., Inc.

1120 Old Country Road
Plainview, NY 11803

YES! Please send _____ db binders
@ \$9.95 each, plus applicable sales tax.
Total amount enclosed \$_____

Name _____

Company _____

Address _____

City _____

State/Zip _____

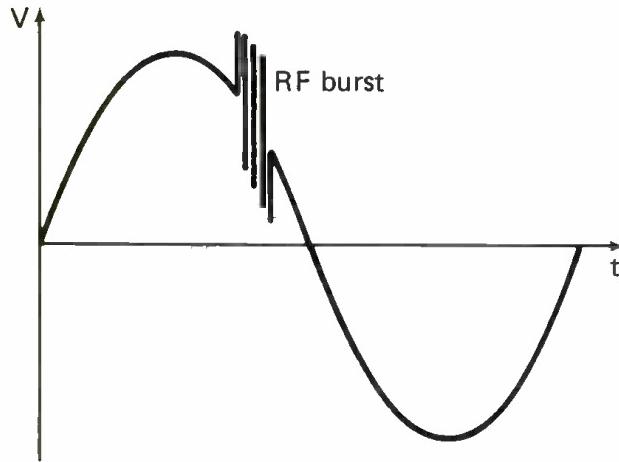


Figure 1. Audio sine wave with RF burst.

were on the order of -70 dB relative to the peak. After further testing, we observed that this only took place when a disk operation was taking place. Additional experiments showed that if the audio was first sent to a 20 kHz lowpass filter, the distortion went away! We now began to think in terms of RF.

Interestingly enough, measuring distortion with a different method did not give the same results as the distortion meter. The problem was clearly not of the classical audio type. The "erroroneous" measurement was not a case of bad test equipment. Using a very widebandwidth oscilloscope, with careful synchronization, we were able to observe an RF burst of relatively high amplitude superimposed on the audio. The size of the RF was a function of which power mains we used for the distortion analyzer or oscilloscope. There are two interesting questions. Where did it come from and how did it create distortion?

We will consider the second question first. FIGURE 1 shows a possible part of the audio signal with a burst of RF added to it. This signal overloaded the input stage of the distortion analyzer because its auto-gain ranging only considered the audio part of the signal. By clipping the RF, on one side, we have effectively created a DC pulse which was added to the audio. The DC had a duration of several msecs. This was the pulse the distortion analyzer measured.

The other question of entry mechanism was traced to the large amount of RF which was generated by the disk system and injected into the power lines. This RF then crawled around the laboratory and entered

the distortion analyzer from the power line. It had no RF trap on it. There was an additional path from the digital control cable connection to the audio subsystem. Both paths played a role.

SOLUTION

The proper way of introducing

Another aspect of good studio design is to use power line RF traps on all equipment that is either generating RF or sensitive to RF. All low-level audio inputs should have RF traps. Racks should be well grounded in the RF sense as well as the audio sense. These two concepts of grounding are not the same. RF grounding basically requires a completely enclosed metal case with no openings: no cracks! Ventilation then becomes a problem. Depending on the frequency of the RF, tiny openings are allowed if they are relatively small compared to a wavelength.

This is only a brief comment on the issues. Before an audio studio introduces computers and digital audio equipment they should become more educated about the manifestations of RF and some of the simple techniques for dealing with them. It is a black-art but one which can be learned. The problem is mostly ignorance. There are several professional handbooks available and there are a few special consulting services which can be purchased locally. The new FCC requirements have created a small industry of

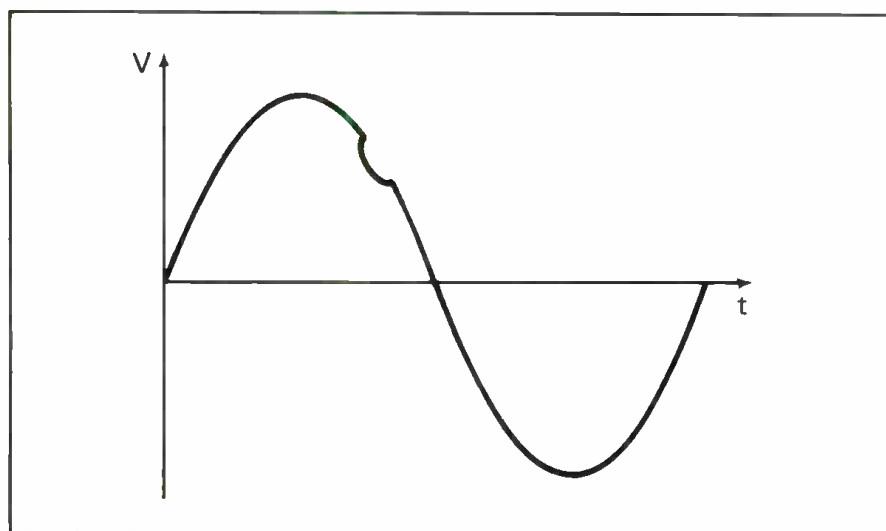


Figure 2. Above signal after overload caused by RF and lowpass to remove RF.

digital equipment into a studio is to insure that the designer had considered these issues. Unfortunately, all computer equipment such as disks are made by manufacturers who do not know of audio. The FCC specifications are not that strict and some equipment will not meet them. Not every piece of equipment is tested, only the basic design proto-type. Few laboratories are able to measure and deal with RF.

experts. If you have an old fashioned Ham radio operator on your staff, from the days when amateur radio was the adult toy, he should be able to help you work with these issues. He may even have a field strength meter to determine the offending equipment.

Before buying digital audio equipment it would be good to ask if the designers had considered these issues. Some companies are now making an effort to deal with them. ■

Boom Operator!

The Unsung Hero Of Television Audio

Being a boom operator is an exacting task that gets little of the recognition it deserves. Here, one of the all-time greats, Bill Golba, vocalizes his thoughts on a changing industry.

On Stage 43 where *The Judy Garland Show* was being rehearsed the new kid walked up to the iron dinosaur that was properly known as an "audio boom," looked up at the operator perched high on his swivel-seat and said somewhat timidly, "Scheduling says I'm your pusher today." The grizzled veteran looked down at him with a skeptical eye and finally asked, "Have you ever pushed boom before?" When the answer was a timid "No," the boom operator said, "All right, son, there are only two things you gotta know, and I can't show you what they are while you're holding that cup of coffee. So get rid of it." When the neophyte set the styrofoam cup of steaming coffee on the boom platform, the operator promptly gave it such a hefty kick that it flew across the stage and landed in the empty audience seats some 30 feet away. "That's the first thing," the boom operator said. "Never set anything on this boom platform."

As the new employee stood there with mouth agape the operator went on to say, "Now, for the second thing, we've got to trade places. You climb up here." As the younger man laboriously made his way up to the seat, the boom operator jumped down, pushed the boom out to the middle of the stage, locked down the wheels, strolled over to the audience area and took a seat in the fifth row, leaving the newcomer perched in the middle of the stage high and dry.

"What'm I doing up here?"

"You'll see."

In less than a minute, the younger one grabbed the back of his neck and ducked away from a source of great pain directly over his head. "What is this?" he winced. Out in the auditorium seats the boom operator shouted, "That's a quartz lamp! Don't ever leave me under one." And with that he declared the training was over.

But of course it wasn't; it was just Jim Williams' way of keeping a "trainee" slightly off balance until he was sure he had his undivided attention. There is so much more to

pushing a boom, and certainly to operating one, that virtually every job on the TV crew is affected by the way it is handled. Audio mixers in particular are the direct beneficiaries of good boom operation, for without it their own chances of delivering a fine product rapidly approach zero. Even the sit-com, normally an easy assignment, can be a disaster for the mixer if his two



Bill Golba holds his favorite microphone for doing boom work: the Electro-Voice 642. At the top is a favorite of today's boom operators, the Sennheiser 416. Also shown are early microphones used for boom operation, left to right: the RCA 77D, the RCA BK5B, and the Altec 639.

boom operators aren't the best. It's the same with dramas and talk/variety shows, or with any production where the bulk of the audio is picked up by boom mics. This means we're talking about 75% of all television, practically everything but news and sports.

Before I dismiss my personal opinion that it's been only a precious few years that multi-camera boom operation has been drawing the talented people it deserves, perhaps I should make a distinction. The movie industry has had boom operators for sixty years or more and I take nothing away from them, but that's a one-camera, one-boom, one-scene-at-a-time situation, having nothing to do with the complexities of today's television where new techniques have arisen out of the need to shoot consecutive scenes without stopping, using several cameras and several sources of sound simultaneously. I do not apologize for the necessity of invention.

A BOOM OF CELEBRITIES

So I can say with some accuracy that as recently as 1970, when my own list of good television boom operators was pathetically small...Jim Williams, John Garrison and a mere handful of others...I dreaded putting out a call to the union for boom operators at Hollywood Video Center (now Merv Griffin's TAV) where I was audio supervisor. They sent me bodies, well-meaning bodies who had little notion of what the job entailed or how to go about doing it. Fortunately for the industry, the demand for real talent in this area has given rise to a growing list of fine performers...Paul Greiner, Mike Smith, Bob Wagner, Murray Siegel, Hal Whitby, Doug Shintaku...a roster becoming too large to accommodate proper credit. Unfortunately, it's not a job that has space reserved for it during the Emmy awards; rather, it's an exacting task that gets awesomely little recognition in return for the savvy it takes to do it right.

Not that anyone's complaining about lack of credit; at least, no boom operator that I know of. Yet, when another one of the "greats" retired last week it struck me that a lot of useful knowledge is walking out the door whenever one of the heavyweights decides to hang 'em up. So when Bill Golba, boom operator *par excellence*, sallied forth into a well-deserved retirement, I was able to persuade him to



On the set of Capitol! boom operator Herman Graft waits for tape to roll.

verbalize his thoughts on our changing industry, particularly as seen from his vantage point on the boom. It looked like a good chance to see our work from a more lofty position and at the same time take a look at an important role in television that is still a mystery to many.

On the drive to Bill's home overlooking the San Fernando Valley I could easily recall the days when I, too, took the boom operator for granted. Why? Because when I moved from radio into television I didn't realize I was being given the top people of the industry to work with. I thought they were all that way! But it didn't take me long to learn the truth: you don't put just *anyone* up there on the boom unless you're running a charity of some kind.

IN THE BEGINNING

Making my way up the twisting road, I had no trouble remembering the first question I wanted to ask Bill Golba:

Today, beginners wanting to operate a boom have some pretty good people to learn from. But who taught you, when television was just getting started in 1950?

No one, and that was our trouble. We invented all the mistakes that were ever made, but we had one great thing going for us: we were on the air live. I kinda feel sorry for the younger people coming in today, whether it be on camera, boom, mixing or whatever, who miss that experience. It's amazing how fast you learn when you're doing a dramatic show "live," as we did on *Playhouse 90*, or *Climax* or *Shower of Stars*. Your memory is really put to a test, and that's what operating a boom is all about...developing a good memory.

KNOWING YOUR LINES

You have to know the lines and remember the action as well as the actors do. You certainly haven't got time to follow a script, although I've seen some operators try to do it. A script is a real anchor around your neck; your hands are too busy running the boom to be turning pages. Not only that, the script is often changed minute by minute, and the boom operator can't afford to get involved with a pencil and an eraser. He's got to be watching the stage at all times to know what's going on, just as he has to listen both to his headset and to the people around him. If you see the director out there on the set instead of in the booth, you've got one ear open because you know he's out there to make changes. What's he saying to these people? You've got to know. Your job is to be aware and remember.

I never look at a script because the show seldom goes that way anyhow. I want to learn the show the way it's *going* to be done, not the way it was *meant* to be done. Oh sure, we have a run-down sheet that tells us the order in which the scenes will be shot, and we stick that on the boom somewhere so everyone can see it, but that's about as close to a script as we get.

Maybe I'm stressing it too much...about not fooling around with a script...but it's worth repeating, because so many newcomers think they have to follow a script just because everyone else does: the stage manager, the actors, the mixer, the director, you name it. But the boom operator doesn't: he learns the dialogue as he hears it being rehearsed.

Now, of course you don't literally memorize every word; all the boom operator wants to know are the key phrases which will mean something to *him*, such as when dialogue moves from one actor to another. If an actor has a long speech, the boom operator doesn't care about all the words in between the beginning and the end. The most

important thing to him is the last line of that speech, for that's when someone else is going to talk. All that stuff in between gives the boom operator a chance to check on the other things he must watch: the shadows he's trying not to make, the picture in his monitor, how much arm he has left in case he has to rack suddenly, and so on. And while he's paying attention to these things, his ear is subconsciously listening for that one sentence the actor is going to utter which means the dialogue will move to someone else. That sentence will stand out in the boom operator's mind as though someone shouted his name. He trains himself to listen to these key phrases; he does not, I repeat, does not waste his time turning the pages of a script. If he needs to be reminded of the exact wording of a certain sentence that was rehearsed two hours ago, he'll step on his foot pedal and ask the mixer, "Hey, what was it that Marie says just before she opens the door?"

AUDIO PREJUDICE

I know in the booth we tend to get a little paranoid about not enough attention being given to audio until it's too late. I suppose you have the same feelings on stage?

Pardon me if I seem to be smiling, but over the years I have become convinced that audio is the bastard child of the industry as far as production people are concerned. They seem to regard it as an ugly wart and they wish it would go away. The only thing I can attribute this attitude to is that audio is a big mystery to them and they're afraid of it. The result of all this, of course, is that they don't allow time for it as they do for camera. They're going after their Emmys because of their pretty pictures, not because of the sound. That's something you learn on your first day in this business.

And never get used to.

True, but you can't let it be a part of your daily thinking or it'll eat you up. You've gotta roll with it. When this happens I feel it's the director's ignorance, not mine. Picture this... (you've seen this a thousand times and I've always had to snicker when it happens): a cameraman is soft on his focus or misses a zoom so that the scene has to be done over again. The director's voice, dripping with patience and understanding, will come out sweetly on the talkback speakers and say to the performers, "Just keep doing what you're doing, folks, everything is fine. We have a little technical problem so let's do it once more, okay?" But if the boom mic gets in the picture, or even more common, if the boom can't get to the subject because a camera's in the way, the director's voice has an ugly edge to it as he calls out with ill-disguised contempt, "I'm sorry, people, but we've got to do it again because of an AUDIO problem!" I mean, he really lays it out. This is really quite funny when you think about it, for it just shows where his education stopped.

But what a pleasure it is to work with one of those directors who's aware of sound and will work with you all the way... Bill Carruthers, Bob Sheerer, Bill Hobin... you know who they are. It makes coming to work a pleasure, for then you can deliver a show you're proud of. *The Carol Burnett Show* was an outstanding example, for director Dave Powers made damn sure that good audio was as much a trademark of the show as good pictures and well-produced scripts.

SOME RARE ASSISTANCE

Let me give an example. Carol Burnett, as you know,

often had big production numbers where singers and dancers were all over the stage on spectacular wide camera shots. In such a situation there was no way a boom could be anywhere near the action; it had to be pulled back almost to the pinrail. This meant that much of the singing had to be pre-recorded so the performers could lip-sync. So far so good, but on a certain place in the number, usually at the end of the dance, Dave would want to cut in tight on Carol for the vocal reprise, to be sung live as the music track continued. Now, I've been holding the boom mic 20 feet in the air to stay out of the way, and sometimes it was hard to remember the exact point at which I had to drop it in quickly for Carol's live vocal, particularly if last-minute changes had been made in the music or choreography. But Dave would call out into my headset, "Billy, I'll count it down for ya!" And he'd do just that, give me a countdown to the exact moment when I could drop the mic in as he cut from a wide shot to a close-up. How many directors do we have who'll do that? Who even know enough to do that? Thank heaven we have a few.

CASTING A SHADOW

Of course, the big bugaboo is boom shadows. I'm sure that problem intimidated you when you were first learning.

Oh sure, it was awful at first, having everyone holler at you about boom shadows. And even today it's an evil we have to live with, but with experience we've learned how to cope. Of course, every good audio man knows that shadows aren't caused by the boom, they're caused by the lights. One of our mixers proved this one day by telling a hysterical producer, "All right, I've disconnected my boom from the wall. The shadows are still there, aren't they?" When the director screamed "Of course they are!" the boom operator said, "Fine. Now disconnect the lights and let's see what happens."

The first thing we learn is that mic shadows are not harmful if they're not seen by the camera that's "on the air." You've got three cameras working, and it does no harm at all if camera #2 sees a mic shadow on the wall when camera #3 is the shot they're taking. Of course, we have to get rid of that shadow before they take camera #2. So, what I said earlier about having to know the actors' lines also applies to the camera shots as well: we have to know when the director is cutting to another camera, either by remembering from rehearsal or listening carefully to his calls in the booth while taping. The better way, of course, is to remember the camera cuts from the actors' lines. This isn't as hard as it sounds, for, if operating a boom is your business, you learn pretty early to remember everything you hear and see while working.

But even when we learn not to worry about those shadows that are being seen only by the cameras which aren't "on the air" at the moment, there comes along another problem to louse us up. That's when an unsure director, in order to protect himself, will have *all* his cameras being recorded at the same time, on separate tape machines. This is an insurance policy he gives himself for the upcoming editing session; in other words, he has more shots to choose from. This puts a burden on the cameramen (who are each shooting the entire show) and on the boom operators who have to keep the mic and the shadows out of three pictures instead of one. Very often this leaves us no place to go.

What do you do in such a case?

Compromise. Play a little higher if necessary, or off to one side. If it sounds presentable to you in your ear-

phones you just keep going until the mixer tells you otherwise. If he's really upset about the quality, it's up to him to tell somebody in the booth, "Hey, you're going to have to live with some bad audio here unless you can change this shot. The booms are trapped."

FALSE PRIDE

What's the biggest ongoing problem you'd bring to the attention of a beginning boom operator?

Letting his sensitivity get in the way of his work. Everyone has pride, sure, and everyone thinks he can take a reasonable amount of criticism if it's warranted. But too often we take comments too personally, and our work begins to suffer. An example is not remembering that other people on the set have their problems, too. More than once I've had the mixer's voice come through my headset, saying, "Boy that sounds great! Just keep doing whatever you're doing." Just as I'm about to pat myself on the back for this, the lighting director steps over and says, "What're you trying to do to me? They're complaining about shadows, and I can't re-light the set just for audio at this late date!" Well, your first inclination is to lower the boom right where he's standing, but when you think about it, the guy may be at the end of his rope with some real problems. So, you work it out with him, and you try to do this without bothering the control room. Of course, if you reach an impasse, you have to call it to the mixer's attention and let him decide how to handle it. With most boom operators I think it's a point of professional pride to try and solve these things on stage, without going to the booth with them.

Or take the case where your own boom pusher is causing problems while trying to protect you. That happened for awhile on the Carol Burnett show, for my pusher (I'll call him Larry) was so dedicated that he had only one aim in life, and that was to put the boom in the most ideal location. If that meant nudging a camera to the left, or sliding a lamp to the right, so be it. Of course that led to trouble, for, as I tried to explain to him, some people felt that there were other elements in the show beside sound.

Nevertheless, I was particularly pleased to have such a dedicated pusher. How much better he was than the type who won't fight for an inch! Still, he had something to learn about the art of compromise. Once in awhile he and one of our cameramen would lay claim to the same floor space; the cameraman announcing that he had to be there to get his shot, and Larry insisting that the territory was definitely ours. Larry's solution on one occasion was rather direct: he just pushed us forward, scraping the cameraman's heels and bumping him in the back.

The cameraman got me aside at the next opportunity and told me, in something just short of a rage, to stop running into him. For a moment I was tempted to tell him to deal with the pusher, not me, but I realized that there really is a chain of command at work here and that I'd better be responsible. The funny part is, if it came to push and shove, we could have won our point, for the camera in this case was truly in our territory (I'm talking about a few feet for a few seconds). But as the Chinese say, you always leave your adversary somewhere to go, so I told Larry, "Look, the next time he does this, let him have the room." Well, Larry just looked at me like I'd surrendered to the Soviets. But when the same thing happened on dress rehearsal, and we came up six feet short, I could hear the director yelling to the mixer, "What's the matter with audio here?" So the mixer asked me, "Billy, you gotta

problem?" I just said simply, "Yeah, we're blocked by camera four." This was the first the director had heard about it, so he said to camera four, "Steve, let me see that shot again." And with that he moved the camera to a new position so our boom could move in and get the audio.

The thing to note is, the situation had reached the point where a decision was needed from an authority which we three didn't have. So I told Larry, "You see? No parking lot fights, no hair out of place. There are people in the booth being paid a lot of money to solve these things. Let them earn it." Larry became an excellent pusher; he may have been zealous to the annoyance of some, but you could depend on him to work. He didn't read paperbacks or do crossword puzzles. We didn't have to hunt for him in the commissary.

A LITTLE HELP FROM SOME FRIENDS

As a mixer I know how I lean on boom people for assistance, but who do you look to for help in getting your work done?

Everyone. The whole ball of wax out there on stage is an exercise in cooperation, otherwise it becomes a Chinese fire drill, you know that. There are so many people who can foul you up if they don't do their job that you just have to cooperate or nothing will get done. The person who's out to do a solo is in the wrong business. I need help from everyone, from the cue-card guys to the stage manager to the actors themselves. And of course, I, in turn, can destroy any one of them if I don't stay awake. (How many times have you seen an actor damn near get a concussion because the boom operator forgot he was suddenly going to lean forward and stand up during a close-up?)

As for accepting help wherever you find it, consider the cue cards. There's usually a person in front of each boom holding cue cards for the actors. Let's say I'm boom 1 and John Garrison is boom 2. The card holder under Johnny's boom is holding cards for the actor under my boom, and vice-versa. That means that I can see the cards that my actor is reading and John can see the cards that his actor is reading. This is real handy, because sometimes we are not given last-minute changes in dialogue, but they are always shown on the cue cards. We can use this as a double-check as to when the dialogue will move from one actor to another. It's not ironclad, but it's one of those crutches we use when cue cards are available.

Here's another trick that usually pays off. As you know, when one boom is covering two actors so that we have to fan the mic back and forth between the two of them, it's critical that we know when each one is going to speak. But actors have a way of lousing us up by changing the wording around somehow. Still, I have found that by watching their eyes and other little clues from their body-language, I can tell when they're going to speak. It's something you learn from their mannerisms. Each actor is different, but usually consistent.

You asked about who we lean on for help. I've already mentioned the value of a good pusher, but just as important is a rapport between myself and the other boom operator. If we work together a lot I learn to sense just when I should cover a piece of action or when he should do it. It's a lot more than simply, "Whose side of the stage is it on?" There are too many variables to consider. Who will cast the fewest shadows? Who has a difficult swing to a following speech? Who has to pull out for a camera move? Who is being blocked by a Corinthian column? Whose boom cable has just become unstrung and there's no time to discuss it? When you work with the

other boom operator for a long time, as I did with John Garrison, you get tuned in to each other's thinking so there's a minimum of discussion over the many problems that crop up. I really believe that after a while you begin to read each other's mind.

Now, these are things that seldom come to your attention in the booth, for there's no reason we shouldn't resolve them on stage. Yet, once in a while it happens that I'm about to go down in flames from a difficult split: one actor is sitting behind a desk arguing with his secretary who's fifteen feet away at a filing cabinet, and I've got to cover their ping-pong dialogue by myself because the other boom, let's say, is engaged elsewhere. Now, in a situation like this, where the dialogue is clipped and rapid-fire, there's no way on God's earth that I can cover both actors unless I know exactly when the speeches change from one to the other. So I worked it out with the mixer who agreed to hold down his foot-pedal and tap on his intercom mice each time the dialogue changed between the man and his secretary. This, of course, puts a little "pop" in my earphones. As it happened it worked out fine, although we knew it was a shaky situation, for if either actor spoke out of turn...if I got 180 degrees out of phase with their lines...from then on it would be a train wreck. But we lucked out.

You've worked both network and freelance. Is there any truth to those who claim that you'll find more diligent workers in the freelance field simply because if they don't perform they don't get called back?

Well, I guess it's true that when you're on staff at a network you get paid each week no matter what you do, whereas out in the field you've got to perform well or you fall out of demand. Yet, some of the finest boom operation I've ever seen was at CBS where I spent so many years. Oh, it's true that sometimes people get themselves scheduled to certain jobs who shouldn't be there, but they don't usually last long.

Yes, I always wince whenever I see someone up on the boom, or pushing a boom, who takes the attitude that he or she was really meant to be doing something else, like being a top comedian or a famous writer, or the president of a jet plane factory. To people like that, who just take up space on the crew, I say, "Get out of the business. You're screwing up the product."

On the other hand, we can get some pretty big rewards from working with cameramen who appreciate our problems and will give us a break on headroom, from lighting directors who will leave us slots to work through, and from mixers who know we have an impossible situation and will persuade the director to change a shot. This business is a series of compromises, and when everyone sacrifices a little while doing his best, it all comes together. That's when we drive home at night feeling good.

THE ULTIMATE MIC

You've got a favorite mic, of course?

I guess we're always on the lookout for the miracle mic that will solve all our problems. Naturally, we'll never find it, but we've come a long way since TV started. At first we just used what was left over from radio, because that's all there was. Today it seems incredible that we put some of those huge clunkers up on the boom. It's a wonder the whole works didn't topple over just from the weight. Some of the first mics were the RCA 77D, the Altec 639, the RCA BK5B...in other words, all those old mics that were handed down from the big radio shows such as the

Lux Theatre, Amos N' Andy, Edgar Bergen, and the Kraft Music Hall. For television they didn't have much reaching power and they cast mammoth shadows, but we got the job done.

Then the manufacturers got busy and tried to help us out with brand new types; some were great while others were horrible. Remember the Sennheiser 805? It may have been great as a shotgun, but I was sure glad when we stopped using it on stage. The pattern was just too narrow for boom work. Once when the mixer had us try it out on the soap opera *The Young And The Restless* I asked him, "Which side of the actors' mouth do you want to hear?" We finally dumped it when Sennheiser came out with the 416, which is a helluva mic.

What is my all-time favorite microphone? You won't believe this, but it's a mic that was actually pretty big and heavy. I'd like to see it used more today, but no one seems to want them anymore. We did *All In The Family* with it all those years. That's the Electro-Voice 642. Oh, I loved that microphone. It had everything: full range, the right amount of rejection...according to my ear, it's the way a microphone should sound.

I quite agree with you.

Well you should, because you and I did about seven years of *The Red Skelton Show* with those things. Remember all the production vocals done on the 642's, backed by the Dave Rose orchestra? That was some microphone.

How did you feel about the weight of it, for the boom?

Not bad. You balanced it, that's all. Making quick moves was no problem. The only time you run into trouble with a 642 on a quick pan was if you didn't have it free-hanging. By that I mean, when you first put it on the boom, you let it fall to its normal angle before you tighten the bracket, otherwise it flops.

Today? Well, microphones go in fads just like everything else, and I think the trend has come full circle, for today we're back to Neumann's aren't we? There's not a boom operator alive who doesn't have his favorite mic, even though the choice is up to the mixer. Now, some mixers are conservative and will spend the rest of their lives with whatever mic did them a good job in 1953, while others are always experimenting. While I was at CBS one mixer had me put a PZM on the boom...you know, that's the mic that's attached to an aluminum plate. Well, we finally had to discard the idea, but I'll give him credit for always trying to improve the sound. I suppose one advantage of a staff job over freelancing is that you have more time to play with these things.

TAPE CAN BE A FOUR LETTER WORD

Any closing thoughts?

Oh, I don't know. It's difficult for me today, even as we shoot everything on tape, to think in terms of, "Well, if we screw it up we can always do it again." I'm glad for the training we got from trying to do the impossible in live television drama. John Frankenheimer, who directed many of the *Playhouse 90* shows, extracted every ounce of blood from us, while giving us a chance to exercise our abilities. But he saw the writing on the wall, for he warned us: "Beware of tape, it's a four-letter word. It's going to destroy everything you've learned about this business."

I guess that's why some of us just keep working as though we're doing it live. We refuse to forget the old *right ways*.

Reflections of A Radioman

Bet it hadn't occurred to you that there was indeed radio as far back as the 1920's. Joel Tall, the man who invented tape editing, will take you back into the past and tell you what it used to be like.

It occurs to me that not many of you out there are approaching eighty. So it may be news to you that there *was* such a thing as radio as far back as the 1920's.

When I left Boston Latin School in 1923 I worked for a short time as a "tube expert" at a parts store on Washington Street in Boston, Mass. (A few blocks away was the *Radio Shack* where they sold mostly old Federal transmitters and receivers of World War I vintage.) Sometime in 1924 I got a job as wireman at the plant of Wireless Specialty Apparatus in Jamaica Plain, near Boston. Part of my time was also devoted to helping Dr. Piccard do a number of experiments on antennas. I ran around on that roof putting up short antennas, long antennas and even noise-reducing antennas! I always had a receiver hooked up to the same wavelength as the operating transmitter and I even thought I once heard a reflection at the wavelength I was tuned to. If so, it was the first radar, but of course, no one paid much attention to a kid who was putting up antennas for Dr. Piccard.

Since I then considered myself a radioman, I was always on the lookout for extra work to add to my income. As luck would have it, I was acquainted with a girl whose father had just bought a deForest reflex, but it didn't work. At the time I thought it was the opportunity of a lifetime so I got a friend (who also worked at Wireless) to help me.

The next Saturday both of us went to work with a vigor. For you youngsters, I'll tell you that the radio we were trying to fix was a deForest "Tombstone," because the top of the cabinet was constructed of paper-mache and held the loudspeaker, a simple paper contraption operated

by an electromagnet with a long needle. We assiduously tested everything there was to test. "A" cells, B batteries—everything checked out but not a sound came from the receiver which was to the only broadcast station in town, WNAC. (Impossible, you say, but I may be wrong. Perhaps we were tuned to a station that billed itself as "Medford Hillside.")

Anyway, we were two stumped so-called radio experts. Then I remembered something that I had read years before in the writings of Lord Rayleigh. Sometimes a magnetic mass nearby could absorb all the magnetic energy at that point and at that wavelength. So we picked up the "Tombstone" and carried it about twelve feet away from an obviously bronze statue. deForest's radio played beautifully and we collected \$50.00 with gratitude. Later I found that the statue was a bronzed hunk of cast iron!

Things seemed to be going too well to last very long. And this turned out to be the truth. We were assembling and wiring the first commercial superheterodyne, what we called the RCA "cat" and the power pack that ran it was called the "tomcat." One day, as I looked at the wiring of the "tomcat" I saw that four wire resistances, although obviously in parallel, were wired separately to the same points in the filter circuit. So, to save time I thought some design engineer had made a small error and I would correct it.

Well, I wired those four resistors in parallel and brought out only four wires to the filter circuit. Of course I was right in my thinking, but I was fired nonetheless, for making an unauthorized change in the circuit wiring.

Thus, I had to look for work elsewhere. However, I noted thereafter that the "tomcat" continued to be wired the way I had done it. ■

Joel Tall invented tape editing.

Read Any Good Rooms Lately?—How To Deal With Room Acoustics

So you say you know all about bad acoustics? Don't be so quick to think there's nothing left to learn. Read on to get a feel for some of the means, both mechanical and electronic, of making up for a "bad room."

One of the most annoying and frequent problems a performer has to deal with is the problem of bad acoustics. In this article we'll look at some of the means, both mechanical and electronic, of compensating for a "bad room."

SOME LIGHT READING

The first thing you should do before you set up in a new room is to "read" the room. Let's assume that you're playing a small club, and that you've gone in early in the day, while the club is closed, to set up and do a sound check. First, walk around and just look at the room. Observe the size and shape of the room, the location and construction of the stage, the materials on the walls, ceiling, and floor, and the furnishings. Later I'll explain exactly how these things affect the sound, but for now just store these observations away. As you walk around the room, snap your fingers, clap your hands, talk at a normal volume, shout, and sing. (Of course, this is best done when the club is closed, but you can even check out a club when it is open and full of customers; just leave out the shouting, and perhaps the singing.) Listen to the sound in the various parts of the room; you're now getting an idea of the acoustic environment of the audience.

Next, go up on the stage and repeat the same procedure, to get an idea of the sound onstage. There are two elements of the sound in any room: how the acoustics sound to you onstage, and how the music sounds to the audience. Of course the latter is more important, and you can learn to live with a bad onstage sound if you know that a good sound is reaching your audience; but you'll probably find that you will perform better if the onstage sound is also good.

Now let's look at what you've learned from "reading" the room. The first thing you've done is to have developed

a sense of the reverberation time of the room. This is perhaps the most important aspect of room acoustics. Unfortunately, in all too many rooms it is far from optimal; fortunately it is fairly easy to compensate for.

REVERB: WANTED—DEAD OR ALIVE

When we talk about a room being "live" or "dead" we are talking about reverberation time (unless we happen to be commenting on the audience). A live room has a long reverberation time; a dead room a short one. The "best" reverberation time for a room is difficult to determine—it involves subjective opinion and depends on many things, including the style of the music. But acceptable room reverberation times can be established within certain parameters, and you can develop a sense for the best reverberation times for your music. Generally, reverberation times of 1.5 seconds or less will sound crisp, while those of 2.5 seconds or more will sound full.

Reverberation time is arbitrarily defined as the time it takes sound to die away to one-thousandth of its original sound pressure, or a drop in sound pressure level of 60 dB. This roughly equals a decay from a comfortable listening level to an inaudible level.

Reverberation time results from the interaction of two factors: the more time sound travels in open air, where very little energy is lost, the longer it will last; but the more often it hits any solid surface, the sooner it will die out. Larger rooms provide more air for sound to travel in and longer reverberation time. More surface area and softer material covering that area means shorter reverberation time.

The calculation of reverberation time is a complicated matter involving Sabine's formula:

where:

$$T_r = 0.16V/S_e$$

T_r = reverberation time in seconds

V = room volume in cubic meters

S_e = effective absorption area in square meters.

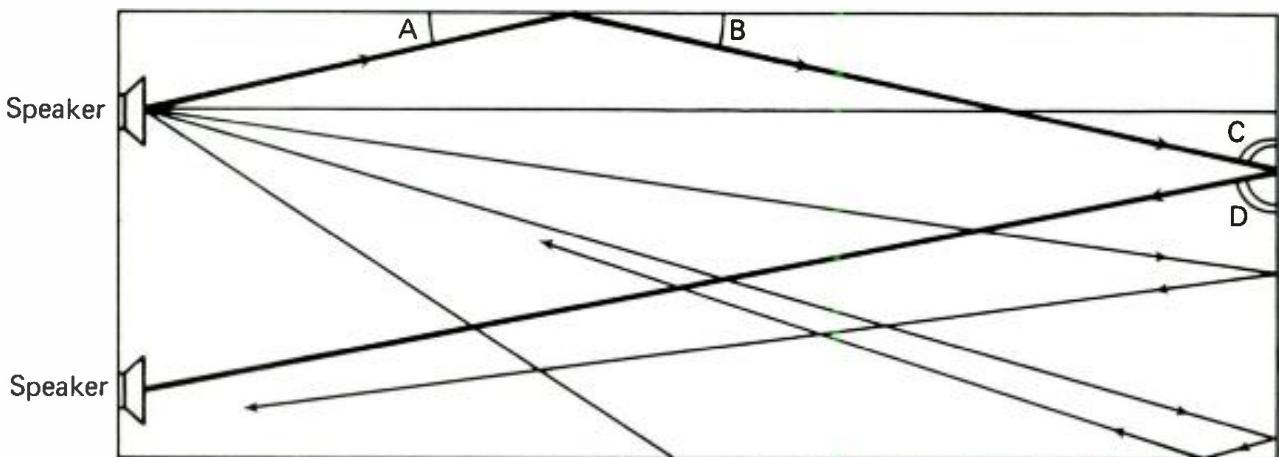


Figure 1. The angle of incidence equals the angle of reflection. Angle A equals angle B; angle C equals angle D, etc. Interference of direct and reflected waves can cause standing waves and cancellation of some frequencies.

Obviously you are in no position to do this calculation during your sound check (or any time, for that matter). But you can develop an ear for reverberation time. A stopwatch, a soundsource, and a good ear can estimate reverberation time of one second or longer, typical in rooms larger than 30,000 cubic feet, which is typical of most small clubs. This figure is significant because rooms with reverberation times under one second are usually considered dead. In other words, your ear can separate the live rooms from the dead ones.

Be sure to distinguish the reverberation time of the room from that of the stage. It is not uncommon to have a live room and a dead stage, or vice versa. For instance, one of the hotels that I've frequently played in Boston has a main ballroom that is too live on the dance floor and too dead on the stage. As we get further into the technicalities of room acoustics, you'll see what might cause this and what might be done about it, but for now just be aware that the relative reverberation times of the room and the stage will in large part determine equipment set-up and adjustment.

So the first thing you've learned from reading the room is reverberation time and how it might vary from stage to room, and even how it might vary in different parts of the room or stage, with "pockets" of echo due to varying absorption and reflection. We'll get into all this in detail shortly.

The next important element of the club's acoustics that you should have noticed in your reading of the room is *coloration*. Colorations, or resonances, are uneven frequency responses at certain locations in the room due to standing waves, also called natural nodes. These can cause certain low frequencies (certain bass notes, for example) to sound too loud in some spots and too soft in others. (Theoretically, there can also be standing waves in the high frequencies, but for various technical reasons they are virtually inaudible and need not concern us.) One of the main reasons for your walking around the entire room and stage was to listen for these standing waves.

SURF'S UP

Standing waves are caused by the reflection of sound. It is easiest to visualize the reflection of sound if we think of sound as a ray. To visualize how sound will be reflected by a flat surface, remember this rule: THE ANGLE OF INCIDENCE EQUALS THE ANGLE OF REFLECTION. This aspect of room acoustics is a sort of an acoustical billiard game. (See FIGURE 1.)

With a little imagination you can visualize just how the sound will bounce around the room. But this method treats sound as if it were a ray. Actually, ray acoustics is not very accurate for frequencies below about 300 Hz. But if low frequency resonance is not too bad, the sound may be sufficiently dispersed so that ray acoustics give reasonable results.

Parallel walls also contribute to standing waves. If any two dimensions of a room are in the same or in multiple relationships (if one wall is the same length as another, or if the height of the ceiling is twice the length of a wall, for example), standing waves may result. So if the room has parallel walls, be prepared to deal with standing waves and their smaller cousins, flutter echoes. Flutter echoes are rapid, machine-gun-like echoes in the high frequencies; a loud hand clap will bring them out. They can be very annoying and can cause both listener and player to experience a very confused and disoriented time sense.

Curved surfaces do not reflect incoming parallel waves in parallel. (See FIGURE 2.) This means that curved walls help break up standing waves and flutter echoes. Curved surfaces also help to create greater echo density. Irregularities (like the sculpturing and statues in a classical concert hall) cause diffusion of the reflected sound impulse, so that in the case of a highly irregular boundary, a single impulse will be reflected as several impulses. In such a case, the complexity of the sound builds quickly with each reflection and is said to have a high echo density. Rooms with flat parallel walls provide

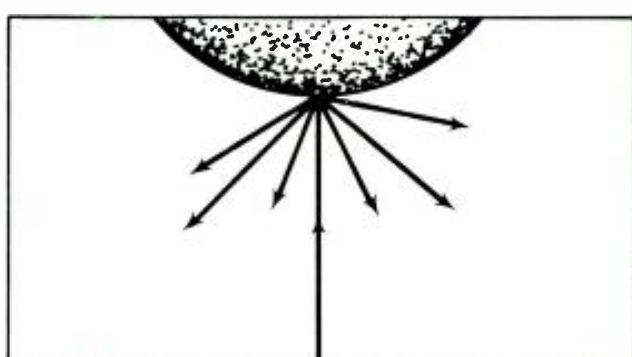


Figure 2. Curved surfaces can create several reflections of a single incoming "ray," increasing echo density and decreasing the chances of the formation of standing waves.

less of a chance for building echo density, and generally have a hard, repetitive sound. Clubs with various alcoves, each having different shapes, sizes and construction, may have pockets of dense reverberation and bands of standing waves.

DON'T JUST STAND THERE—DO SOMETHING!

Now you've read the room and thought about some of its sonic strengths and weaknesses, so what can you do about it?

There are two ways to bring out the strengths and suppress the weaknesses: mechanical and electronic.

The mechanical solution to acoustic problems involves proper equipment set-up. If the room has excessive reverberation time, you can shorten it somewhat by aiming speakers at any absorbent areas, like curtains, heavily padded furniture or acoustic tiles. If the floor is hard and there is acoustic tile on the ceiling, tilting some of the amps or speakers back and aiming them at the ceiling may help.

If, on the other hand, the reverberation time is too short, aiming speakers at highly reflective surfaces like large plate-glass windows or plaster walls might help.

If the band is set up on a stage with curtains, you can move the curtains to different positions to control on-stage echoes.

There are several strategies you can use to control colorations.

Aiming speakers at any available angled surface might help. But this will not help much in the bass range, since resonances there have more to do with room volume than shape.

Sound is reflected from objects that are large compared to the wavelength of the sound. A person will reflect highs (10 kHz; wavelength about one inch), while lows (20 Hz; wavelength about 56 feet) will sweep past as if the body didn't exist, leaving very little "shadow." So aiming speakers at support columns will help high frequency dispersion, but will not do much to eliminate standing waves.

Resonances that color male voices (in the 100 to 175 Hz range) and resonances that color female voices (around 200 to 300 Hz) are a special problem, so mechanical means (speaker placement and aiming) may be of little help here. Try moving a speaker a foot or two, especially keeping speakers away from walls and corners, which increase the low frequency response.

Now we can see how set-up can help solve room acoustic problems. Excessive reverberation time can be compensated by aiming speakers at absorbent surfaces. Standing waves can be eliminated by bouncing sound off curved surfaces. Weak lows can be strengthened by placing speakers in corners and/or on the floor. Excessive lows can be eliminated by keeping speakers out of corners and getting them up off the floor.

But with particularly stubborn rooms all this may not be enough. This is where technology comes to our aid.

LIVEN IT UP

There are two kinds of signal processors that can liven up dry rooms: reverbs and delays. Each comes in both analog and digital form. The simplest type of analog reverb consists of a spring (like the reverb on many guitar amps). Not so many years ago this was the only kind of reverb available on PA's. Spring reverbs are adequate, but usually have a fixed echo density and limited flexibility. Recently digital reverbs have become

available for stage use. These allow greater control over decay time and echo density, and provide sophisticated touches like damping and pre-delay. Damping simulates the effect produced by absorbent walls or large rooms, cutting the highs in the echoes; pre-delay separates the initial sound from the echoes, adding clarity. Digital reverbs can even be programmed to simulate different kinds of reverberation, like studio plate reverbs, or to simulate different size rooms with walls that are hard or soft, flat or curved, plain or sculptured.

The primary difference between reverbs and delays is that reverbs create continuous echoes, while delays create distinct echoes. Analog delays usually provide delay times between 10 and 300 microseconds. Digital delays can provide delays of a second or more. Note that here we are talking about *delay* time, the time between when the note is sounded and the time when we hear it, and not *decay* time, the time that the echoes last. All delays include a regeneration stage, however, which will, through sequences of delays, cause the sound to decay more slowly.

TEST YOUR IQ ON EQ

Technology can also come to our aid in solving EQ problems. Real time analyzers are available that will analyze the frequency response of the room and show you an LED readout that indicates the setting of graphic EQ that is needed to create a flat response. There are even graphic equalizers available that will automatically set their own sliders to the curve prescribed by the real time analyzer. The main problem with real time analyzers is that they are only accurate for one spot in the room: the spot where the microphone attached to the analyzer is placed. So these devices should only be used to get an approximation of where the trouble frequencies lie; from there on use your ear.

In solving EQ problems there are two tools, each with its own purpose. Graphic equalizers are best for creating a smooth frequency-response slope; parametric equalizers are best for centering in precisely on one narrow problem frequency band. Your "reading" of the room should give you a good idea of what the problem frequencies are, and after a while you'll be able to pick them out on the equalizer. The best method here is good old trial-and-error. You'll be amazed at how much moving a slider a fraction of an inch on an equalizer can change the sound.

END NOTES

So now that you've learned to read a room, it's time to start keeping track of your reading. Each room has its own character, its own strengths and weaknesses, and each room will demand unique solutions. Keep a notebook handy and make notes as you read each room. Diagram the room, perhaps sketching the shape of a few sound waves as they bounce around. Note the materials, shape and general sound of the room, and mention specific problems (stage in the corner—bass too boomy). And most importantly, when you find a solution to a sound problem, write that down, because what works in one room may work in another, similar room. All of this writing takes a little time at first, but in the long run it will save you time. You can always say, "Now where did I run into this problem before? Oh yeah! At that club with the glass wall across from the stage. And what did I do there?" And then you can look it up. With all the different clubs and all the different sounds, it's easy to forget all your sound solutions, so keep track. ■

Updated Recording Studio Handbook

A must for every working professional... student... audio enthusiast

Features latest state-of-the art technology of creative sound recording.

21 Fact-Filled Chapters

- I. The Basics
 - 1. The Decibel
 - 2. Sound
- II. Transducers: Microphones and Loudspeakers
 - 3. Microphone Design
 - 4. Microphone Technique
 - 5. Loudspeakers
- III. Signal Processing Devices
 - 6. Echo and Reverberation
 - 7. Equalizers
 - 8. Compressors, Limiters and Expanders
 - 9. Flanging and Phasing
- IV. Magnetic Recording
 - 10. Tape and Tape Recorder Fundamentals
 - 11. Magnetic Recording Tape
 - 12. The Tape Recorder
- V. Noise and Noise Reduction
 - 13. Tape Recorder Alignment
 - 14. Noise and Noise Reduction Principles
- VI. Recording Consoles
 - 15. Studio Noise Reduction Systems
 - 16. The Modern Recording Studio Console
- VII. Recording Techniques
 - 17. The Recording Session
 - 18. The Mixdown Session
- Three all-new Chapters
 - 19. The In-Line Recording Studio Console
(The I/O Module, The Basic In-line Recording Console, Signal flow details)
 - 20. An Introduction to Digital Audio
(Digital Design Basics, Digital Recording and Playback, Error Detection and Correction, Editing Digital Tapes)
 - 21. Time Code Implementation
(The SMPTE Time Code, Time-Code Structure, Time-Code Hardware.)



\$39.50

The Recording Studio Handbook is an indispensable guide with something in it for everybody. It covers the basics beautifully. It provides in-depth insight into common situations and problems encountered by the professional engineer. It offers clear, practical explanations on a proliferation of new devices. **And now it has been expanded with three all-new chapters... chapters on the in-line recording studio console, digital audio and time code implementation.**

Sixth printing of industry's "first" complete handbook

The Recording Studio Handbook has been so widely read that we've had to go into a sixth printing to keep up with demand (over 30,000 copies now in print). Because it contains a wealth of data on every major facet of recording technology, it is invaluable for anyone interested in the current state of the recording art. (It has been selected as a textbook by several universities for their audio training program.)

Highly Acclaimed

Naturally, we love our book. But don't take our word for it. Here's what others have to say:

"John Woram has filled a gaping hole in the audio literature. This is a very fine book... I recommend it highly." *High Fidelity*
"A very useful guide for anyone seriously concerned with the magnetic recording of sound." *Journal of the Audio Engineering Society*

15-Day Money-Back Guarantee

When you order *The Recording Studio Handbook* there's absolutely no risk involved. Check it out for 15 days. If you decide it doesn't measure up to your expectations, simply send it back and we'll gladly refund your money.

Easy to Order

You can enclose a check with your order or charge it to Master Charge or BankAmericard/Visa. Use the coupon below to order your copies of the new updated *Recording Studio Handbook* (\$39.50).

ELAR PUBLISHING COMPANY, INC.
1120 Old Country Road, Plainview, N.Y. 11803

Yes! Please send _____ copies of THE RECORDING STUDIO HANDBOOK. \$39.50 plus \$2.00 to cover postage & handling.

Name _____

Address _____

City/State/Zip _____

Total payment enclosed \$ _____
(In N.Y.S. add appropriate sales tax)

Please charge my Master Charge
 BankAmericard/Visa

Account # _____ Exp. date _____

Signature _____

(changes not valid unless signed)

Checks must be in U.S. funds drawn on a U.S. bank.

Mixing For Television

There are critical differences between audio sweetening for video and traditional audio recording. Read on for several tips on how to make a smooth transition.

Day by day, top flight audio and video facilities across the country are expanding or upgrading their services to meet the ever growing demands of audio sweetening for video. It is not unusual to hear of video post production houses installing 24-track mixing suites or multitrack recording studios buying high ticket video gear to tie into their systems. Meeting the demands of a new service that your company may not be of use to is no easy matter. If you and your company is moving into this field, a comparison of the differences between audio sweetening for video and traditional audio recording may be helpful. Whether minor or drastic, all of these points can be critical to the success of any project.

SWEET DIFFERENCES

First of all, when working in television audio, you'll find that the dynamic range is vastly reduced over Hi-Fi recording. This limitation must always be taken into consideration with any television mix. Soft compression and limiting of the *entire* mix is a standard solution to this problem. YOU do the dynamics control before it reaches the station's limiters so your client won't call you the next day asking, "What happened to my mix?"

Second, you must remember that television audio is *mono*. Even though stereo broadcast television is on the horizon, how many years will it be before the majority of viewers will be listening in stereo? And when that time comes, you will be faced with a whole new set of problems—a topic for future discussion. Until then, you

*Joe Moore is in charge of audio sweetening at
VIDEO TAPE ASSOCIATES in
Hollywood, Florida.*



Control room at Video Tape Associates in Hollywood, FL.

must always think in terms of a mono mix. Subtle whispers in a mix are psychoacoustically perceived in the stereo image much easier than through a small four-inch TV speaker. One solution to this problem is an aural exciter. Using apparent loudness and artificial harmonics, an exciter can bring out the subtleties that need to be heard on the air.

Something important to remember here is that all mixing for television should be done through a very small speaker. Proportional relationships between one audio element and another can best be mixed on a small monitor speaker. A budget of \$10 for your mix speaker is verging on excessive.

Another difference that you will encounter is the

number of generations your mix will go through before it reaches the air. Here is a typical example: Your client shoots on film and transfers their work print to one-inch video tape. All of the audio elements are assembled on the multitrack and mixed back to the one-inch work print. During the video edit, the mix is lifted off the work print and recorded to the one-inch video master. The master is duped to two-inch video quad and sent to the station. The station then dupes the quad to two-inch video cart for broadcast. The commercial may be running on a half dozen or more stations. The generation loss can really take its toll in dynamics, brightness and overall quality. With the automatic emphasis at the transmitter to boost the voice frequencies, the music and effects are the first to disappear. One suggestion is to always push your music and sound effects slightly beyond normal levels.

Some additional differences I have found:

1. Music is rarely the principle element in a television mix.
2. Unlike album projects that can go on for weeks, audio sweetening sessions are usually short and fast. The average is about two hours and a busy studio will have three to five sessions a day.
3. Most out-board gear in audio sweetening is used for problem solving (i.e., dynamics control, voice enhancement, room simulation, etc.) and not for special effects.
4. If you are building an audio sweetening room, you may not need a large sound room. Usually a voice-over booth will do. A Foley studio is the exception.

There are many other differences, but these seem to come up on a daily basis. Once you understand some of the major ones, then you must decide how deep into audio sweetening you want to go. One big factor is budget. The quantum leap occurs with the difference in the price tag of a good $\frac{3}{4}$ -inch video cassette deck (about \$3,000) and a one-inch Type C video recorder (starting at \$60,000). Those kind of differences can help you make up your mind real quick.

One alternative that smaller studios are considering is the Video Layback machine. Rather than mixing to a one-inch video master, use a $\frac{3}{4}$ -inch time coded cassette copy. Once the mix is done, use the layback machine to transfer the mix to the one-inch master. The layback machine is a fraction of the cost of a one-inch Type C unit and much easier to maintain.

NECESSARY GEAR

Whether you go the $\frac{3}{4}$ -inch or one-inch route, there are other pieces of gear that you will need. Let's assume you already have a good quality mixing console and an 8, 16 or 24-track machine and go from there.

First, a machine control synthesizer is a must, preferably one that can give discrete edit commands, the most important being "Preview." This allows you to hear your edit before you actually record anything, making razor blade editing a thing of the past.

Second, in addition to your video master machine, you'll need a good color monitor—one that everyone in the room can see. I suggest one of the many rear projection units available today.

Third, to tie everything together, you must have a sync generator and a time code generator. The sync pulse generator is the house reference for your entire operation and insures that all machines are running at the correct speed.

Fourth, you will need an additional multitrack to serve as your source machine. A four-track is perfect since it allows you to handle mono or stereo elements and still have a separate channel for time code. Your synchronizer must obviously be able to control at least three machines—the master video, your multitrack and your source machine.

Though this list is far from complete, it forms the basis for a solid audio sweetening setup. Having such items as a good music and sound effects library on hand will extend your services and expand your income.

IN SESSION

Now let's look at a typical audio sweetening session. Step one is to take all of the audio elements that you will need to complete the project and record them on your source machine. The tape used should already be striped with continuous time code. You may be dealing with many different types of audio such as records, a live announcer, magnetic film, etc. As you conform these to your source reel, the time code location of each should be noted. That way, calling up each sound can be easy and fast.

Next, the offset between the time code on the video master and the time code on your 24-track should be established and entered into your synchronizer. The offset is the numeric difference between the two and in most cases will not change throughout the session.

Once the offset is established and the two machines are interlocked, any audio that is on the master should be transferred to the 24-track. This is called the "layover." An example of audio that may already be on the master is "on camera" voice syn that was edited from the shoot footage during the video edit. At this point, your client may choose to replace the real voice with lip-sync voice talent using the same person that was on camera or another announcer. Having a video monitor in your voice-over booth is a must.

Perhaps there is music on the video master that was needed during the edit. This can be used as a reference but when possible this should be replaced on the 24-track to insure the best quality.

Remember, the time code on the 24-track is just like any other audio element and must be in "que" while overdubbing is done. Also, it is somewhat helpful to think of the video machine and the 24-track as being one in the same. Even though they are physically two separate machines, their time code relationship will not change. At this point in the session, you will take each element on the source machine, assign it to a channel of the 24-track and sync it up using your preview function. Once all the elements are recorded on the 24-track, set up your mix and "layback" to the one-inch video master. Remember to use a small TV speaker to determine realistic proportions.

In the future, as stereo broadcast becomes more commonplace, one consideration of your studio will be 32-tracks or more. This is because most elements will be stereo and will take up two tracks each. Digital sampling and storage of sound effects will also become important as well as disk storage of the edit decision list—a feature you may want to look for in your synchronizer system.

This should give you an idea of what audio sweetening is about. You'll find as I have that audio sweetening is a very exciting and specialized branch of the audio industry and to do the job right will keep you on the front edge of the latest technology. ■

Technical Postcards

Now there's a technical postcard?! No, we kid you not—Nicholas Communications has just released a "video postcard." Read on for the full picture...

POSTCARDS HAVE BEEN around since the first time my great-grandfather took a trip. Their form has remained virtually unchanged since their inception, with cost and manufacturing techniques being the only variables.

Now you might wonder why I'm wasting all this time and space to talk about something as uninteresting as the postcard. But postcards just got interesting. And technically at that. Nicholas Communications of Alexandria, VA, has just released a 'video postcard'—the first in a series—featuring the sights, sounds and "feel" of the nation's capitol, Washington, D.C., on a 30-minute video cassette.

Upcoming releases will feature major US and European cities and the tapes will be distributed through museum shops, hotel gift shops, video retailers, audio hi-fi stores and book stores; and be available to public libraries and educational facilities.

Founder of Nicholas Communications, Stephen J.

Sammy Caine is the technical editor of db Magazine as well as a free lance writer in the music and recording industry.

Nicholas, (producer and director of Washington D.C.) explains, "The video software line we're currently producing represents a synergy of existing technologies. Through the integration of state-of-the-art audio recording techniques and video processing equipment, we've created a digital tour de force. We have taken sight, sound and motion—the preferred medium of communication in the 80's to its limits."

Recording techniques for the audio portion of the multi-media 'postcard' include using the Soundfield Calrec Microphone in conjunction with the Ambisonic encoder/decoder and by integrating coincident Ambisonic techniques, the sound gives a very convincing illusion of depth, and, in effect, 3-D audio.

"Since my background is in the visual arts, as well as in audio production, it seemed the 'natural' thing to do—synchronizing musical imagery, i.e. colors, textures, hues and moods and visual images to produce the sights and sounds of some of the great cities on our planet. We're presenting this form of information/entertainment in a long-form music video that takes the viewer on a thrilling journey."

The project was a difficult one, Nicholas freely admits,



and they encountered many problems synchronizing the digital audio with the video. However, with the expert advice of Mack Emerman, president of Criteria Recording Studios in Miami, and his skilled staff, Bob Lifton, president of Regent Sound, NY, and chief engineer of the "We Are The World" music/video, and engineers flown in from Mitsubishi headquarters, the difficulties were quickly resolved. Nicholas and his staff rented out the highly touted Studio E at Criteria. Mack Emerman, always a trendsetter in the recording industry and considered to be one of the top engineers in the world, was eager to work on the project as he felt it offered new challenges and opened up new dimensions in the recording business.

A Mitsubishi X-800 32-channel digital recorder was shipped to Criteria from Digital Associates in Nashville. The mixdown was done digitally using a Mitsubishi X-80 master recorder. Along with Tom Gandy of Calrec Soundfield, Nicholas recorded live natural sounds which were laid into the final musical track. All the information was then encoded UHJ Ambisonically using specialized Ambisonic techniques.

The opening of the cassette is heralded by the loud roar of Huey helicopters which seem to hover directly overhead as the listener/viewer sits in his/her living room. The production was then moved to Editel/Chicago, a video editing and post production house where the new Montage picture processor was used to assemble the visual imagery.

Nicholas explains, "The conventional approach to off-line editing, loading tape in and out of VCRs, fast forwarding and rewinding takes countless hours. One can become so hung up in the technology that he tends to lose his creativity. With the Montage, we were able to react

instantly, create on the spot what often takes weeks to accomplish. It freed my mind and gave me time to assemble everything creatively on-line with engineer Jerry Doskoczynski at Editel/Chicago. This savings in time and budget allowed tasteful usage of digital effects. Equipment such as the ADO, Mirage, Quantel Paint Box, and other digital video effect machines were used.

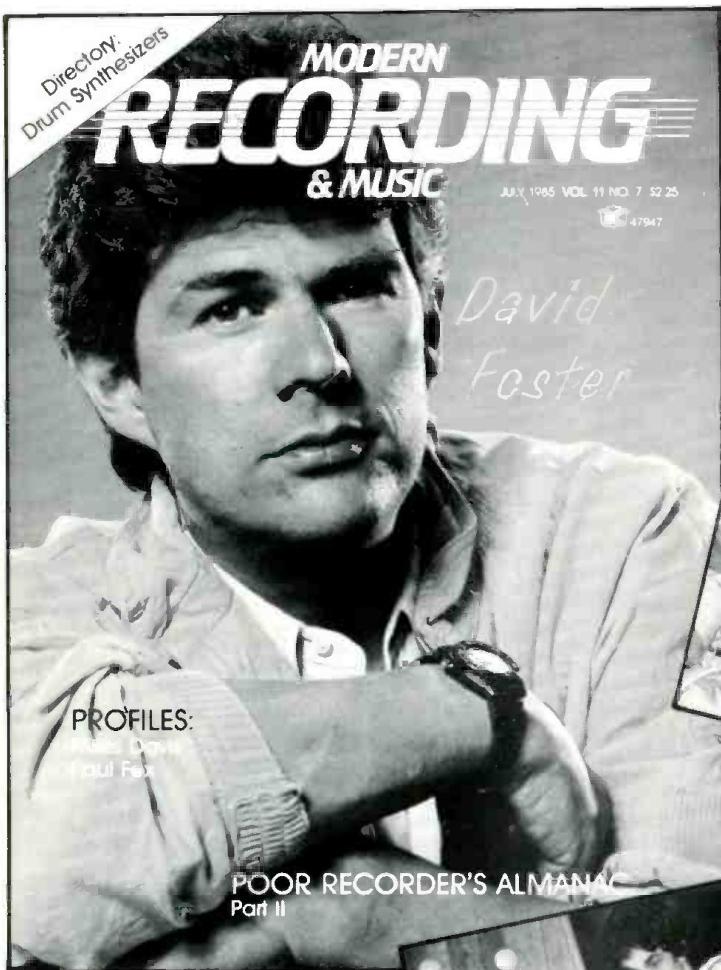
In Los Angeles another phase of production occurred at Transamerica Video where the talented editor Marci Dubrow and Academy Award nominee animator, David McCutcheon, assembled the visual opening of the "Washington, D.C." production on the Mirage Computer.

An exciting three-minute forty second breakdance segment featuring the "Mighty Poppalots," a D.C.-based dance group who have movie and TV credits, was shot on location at various historical monuments by cameraman, Jeffrey Saffelle, with a Thompson CFS Betacam.

A year ago, Nicholas and partner/associate producer, F. Denise DelGandio, had a faint glimmer of an idea; they knew they wanted to create something for the consumer combining the audio and video media. While in Cannes, France attending MIDEV, the annual music convention, they were so enthralled with the area that they wanted to capture the sights and sounds of the posh Mediterranean vacation spot and take them home with them. As they began talking, ideas formed and after a while the concept of a "moving musical postcard" was born.

Time lapse and aerial photography on 36mm film was supplied by the award winning cinematographer, Louis Schwartzberg. The final digital audio mix and video were synchronized at Criteria Studios and shipped to CBS-Fox in Detroit where duplication to VHS and Beta HiFi videocassettes completed the project.

"Washington D.C." will retail for \$29.95.



The Technology of
Tomorrow... Today!



Profile: Cherokee Recording Studios

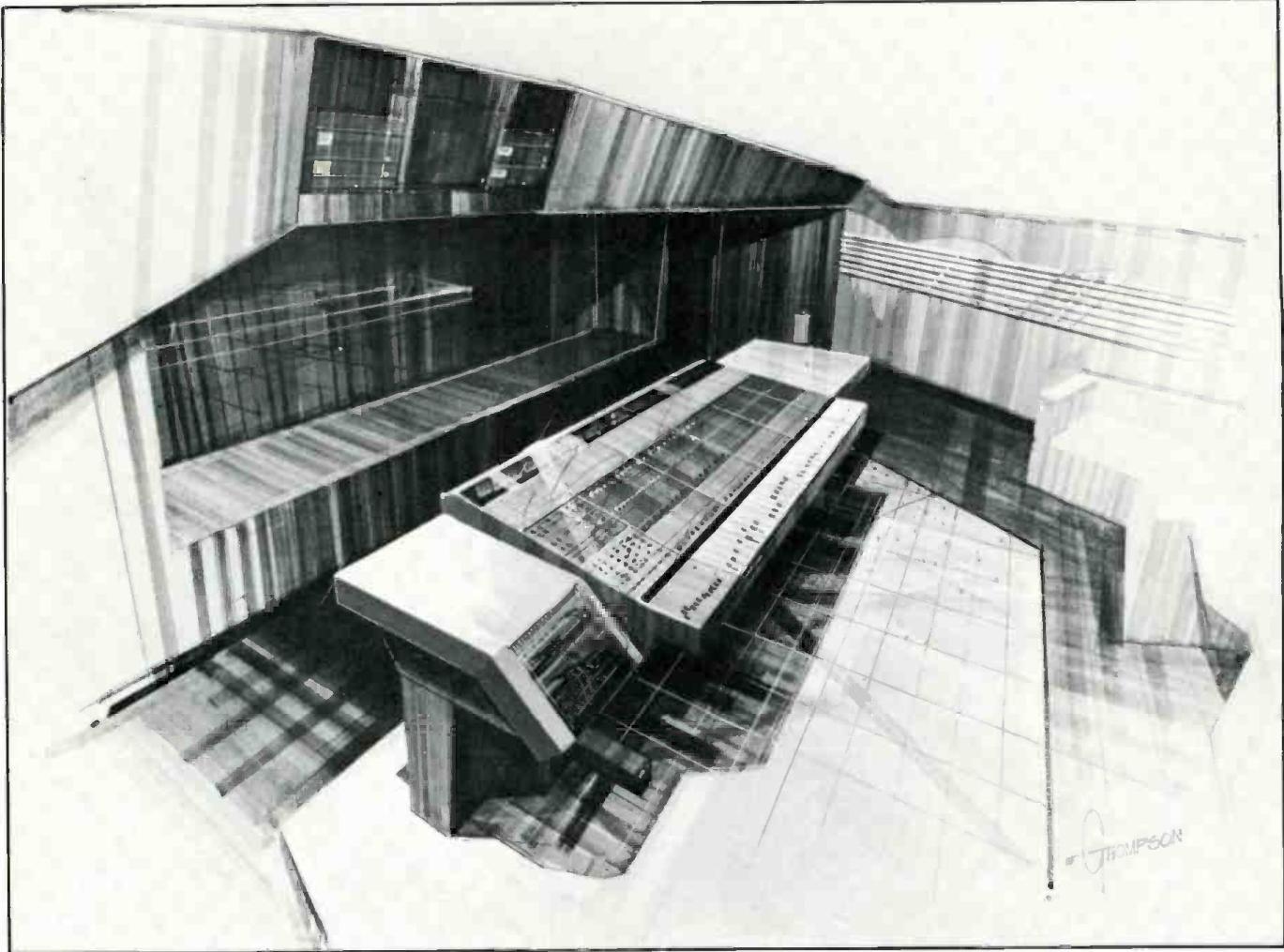
Beginning this month with Cherokee Studios db will feature a new column profiling different studios around the world.

THE MAJOR PORTION of the population has a rather vague concept of the music business. They envision the industry as a facility that provides rooms with microphones and music stands, where strangers can walk in off the street with a guitar and a song; where keyboard men and drummers quietly materialize and pick up the beat, and hits are born. They imagine a crew of crazed rock-and-rollers who can't tell the difference between a balance sheet and a baffle, trying to make records in a studio that doubles as a rec room. Television invariably portrays recording studio owners as lower echelon racketeers who solve all their problems by liquidating competitors and clients alike.

The truth is far different. One Hollywood based business that has had a hand in generating 1.5 billion

dollars worth of records over the last 15 years takes its music business very seriously indeed. Just ask Michael Jackson, Bob Dylan, Rod Stewart, Frank Sinatra, Neil Diamond, Duran Duran, Barbra Streisand, The Cars, John Cougar Mellencamp, David Bowie, Diana Ross, Journey, Toto, Hall and Oates, Air Supply, Pink Floyd, Olivia Newton-John, Motley Crue, Twisted Sister, Bob Seger or Steely Dan, among hundreds of others who have recorded at Cherokee Recording Studios. Over 175 million records have been sold which were recorded, in whole or in part, at Cherokee. Notable producers such as George Martin, Roy Thomas Baker, Tom Werman, Quincy Jones, Mike Chapman and Bob Ezrin regularly fill their four studios.

"A segment of the industry views us as innovative;



another segment considers us insane," says Dee Robb, one of the studio's founders. "Actually, we are a paradox. Some of our moves seem daring but in reality we operate very conservatively."

PROSPER IN THE FACE OF ADVERSITY

As a result of the extensive international recession and the accompanying near disastrous downturn in the music industry, the mortality rate among recording studios reached a staggering figure in excess of 50%. In the face of this dismal outlook, last year Cherokee saw the largest net profit in its history. How have they prospered while all around them others were losing their shirts? "We have become as financially oriented as any studio in the business," says Dee. "As the downturn continued we sensed that this was not just a temporary, seasonal decline. We stopped dreaming of the bountiful 70's when recording stars could book a studio 24 hours a day, for weeks and then allow it to stand idle for days, perhaps setting up a ping-pong table, or devising a race track for tiny, scale model, radio controlled Indy cars. Some would depart for a weekend of fun, well aware that the meter was still ticking. It was total insanity. We became progressively uneasy. The album budgets granted to the artists by the record labels reached near astronomical proportions. There was chaos when the bubble finally burst. Many studios attempted to buy their way out of the recession. They invested in elaborate, overpriced equipment, hoping to gain an edge on the competition. What they failed to realize was that the business they

were attempting to attract no longer existed," Dee explains. "They expected the industry to rebound as it had several times in the past decade. They believed the labels would again agree to pay higher rates for the new technology. We, on the other hand, reached the very painful, but to us, obvious conclusion, that the golden days of the virtually unlimited budget were gone forever. Slowly, the recession became a challenge. To survive demanded all our skills. We spent many hours researching, absorbing, applying, analyzing."

WE ARE FAMILY

The family atmosphere that exists at Cherokee has undoubtedly contributed to the success of the operation. The studio staff all feel that they are partners in the business and this is the way the owners want it. The Robbs (Dee, Joe, and Bruce) and their father, Dave Sr., hold all the stock in a closed corporation. They, with Con Merten, a long time associate of over 18 years, comprise the Cherokee management. Dave Sr. as president is liaison to all financial and political organizations with whom the company deals. Dee handles all technical aspects and day-to-day financial operations. Joe heads the engineering division and plant control. Bruce is in charge of special projects constituting corporate acquisitions and all construction and updates in the complex. Con Merten heads sales promotion and publicity, supervises the traffic division and PR. He is also studio manager. As an accredited attorney, he directs legal and contract work. Susan (Dee's wife) supervises the office and clerical staff.

STARTING OUT

Building major corporations from bootstrap beginnings has been a family tradition. Robert Donaldson, their great grandfather, was a Scottish marine engineer who emigrated to America and opened a small machine shop on the Detroit riverfront. A young farm boy named Henry Ford served his mechanical apprenticeship there. The firm eventually grew into the Detroit Drydock and Shipbuilding Company, the largest builder of freighters and cruise ships on the Great Lakes. Dave, their father, an industrial engineer, founded a consulting and manufacturing firm in Milwaukee, developing and building production machinery and automated materials handling systems for large corporations in the midwest. Dee, Joe and Bruce, formed a group in their early teens, and became popular locally, performing for school dances and teen clubs. To celebrate Dee's 16th birthday, the brothers purchased an antiquated highway coach and shortly thereafter, with meager finances and with Con Merten as their manager, departed on an unscheduled musical odyssey that lasted several months and covered the east coast from Miami to New York City. When they returned filled with enthusiasm they had become seasoned professionals.

With no further ado they returned to the ranch and began clearing out a small barn. Then, ignoring unimportant details such as building permits and securing permission from the property owner, began construction. "At this point, we began to appreciate the advantage of a team of experts. Here, within the family, we had

knowledgeable electronic technicians, experts in comparative audio characteristics of building materials, an industrial designer/engineer and even our own attorney. We collected information from everyone we knew who had built studios; sorted it out; added our own innovations and crossed our fingers. We bought some antiquated, custom built equipment that, we discovered, had amazing acoustic qualities. In later years, this equipment was recognized for its excellent sound and became very valuable. The console was a blessing in disguise. We discovered that when removed, all the wires had been indiscriminately cut, with no schematics available. Figuring out the circuitry from scratch took years off our lives and added years to our technical knowledge.

Old friends and associates such as Del Shannon, the Turtles and Little Richard stopped by to check us out. They loved the studio and began cutting demos (on a gratis basis). The commercial value of the facility dawned on us when, months after completion, we realized that we had not had the time to record ourselves. Inadvertantly, our performing days were over. After ten years of being on the road seven or eight months out of twelve, our enthusiasm for touring had waned. The studio had us hooked. We lived in it 16 or 18 hours a day, expending the energy and time we formerly gave to building the group.

Cherokee Studios was launched as a commercial venture. The first paying client was charged the exorbitant fee of \$10.00 per hour. (A few years later, the rates had taken a "modest" increase: about 2000%).

Without warning, the owner of the ranch put a FOR SALE sign on the studio. Involved in numerous

Looking for a Distortion Measurement System?

The Amber model 3501 is quite simply the highest performance, most featured, yet lowest cost audio distortion and noise measurement system available.

It offers state-of-the-art performance with THD measurements to below 0.0008% (-102dB), maximum output level to +30dBm and noise measurements to below -120dBm.

It has features like automatic operation, optional balanced input/output and powerful IMD measurement capability. It includes comprehensive noise weighting with four user changeable filters. Unique features like manual spectrum analysis and selectable bandwidth signal-to-noise measurements.

The 3501 is fast, easy to use and its light weight and small size make it very portable. It can even be battery powered.

And the best part is that it is 20% to 50% below what you would pay elsewhere for less performance. The Amber 3501 starts at \$2100. Send for full technical details.



amber

Amber Electro Design Inc.
4810 Jean Talon West
Montreal Canada H4P 2N5
Telephone (514) 735 4105

Circle 25 on Reader Service Card

projects—all three of the brothers were noteworthy engineers by this time—and armed with a commitment from Steely Dan for an entire album project if they could provide 24-track facilities—they set out to find a new studio.

The MGM complex in Hollywood had been acquired by Polygram and was consistently losing money. They decided to dispose of the 10,000 square foot facility and the Robbs purchased it in 1975. "Making a move of this magnitude without outside financial partners was, to say the least, an ambitious venture. Our family invested some money and we felt a tremendous obligation."

At this point, Toby Foster, recognized as one of the top audio design engineers on the west coast, joined the team as technical director. His input was responsible, in great measure, for getting the new enterprise off the ground. Back then, a good portion of building a studio was black magic. There were only a few qualified audio consultants and all of them had opposing opinions. We adopted a standardized scientific approach. We encountered a nightmare electronically. Every time we opened a wall we found trouble. The experience gained in constructing the ranch studio stood us in good stead. We acquired a new 24 track console. One of Toby's early contributions was the conversion of two existing 16-track tape machines into one 24 track unit. From its unorthodox appearance this innovation became internationally known as the "Banana." It served with honor for years and produced countless hit records. Hundreds of subsequent developments and modifications have culminated in Cherokee's latest creation—a technically and sonically advanced but uniquely simplified recording console. "We were operating in the black from the moment we opened the doors and have been running around the clock ever since."

COMING THROUGH

Rick Nelson was their premiere act and Steely Dan made good on their promise, recording the studio's first gold album, *Pretzel Logic*. Cherokee made more waves in 1975 when producer Richard Perry brought Art Garfunkel in to record his Breakaway album. Perry's endorsement led to Rod Stewart and David Bowie (for both his *Station to Station* and *Changes* LPs).

Much of their success is based on the fact that they were musicians-turned-engineers, a unique, valuable combination.

The group was then known as "Dee And The Starliners." (It is just possible that "Joey Dee And The Starlighters" may have had a slight influence on the selection of this name.) They shortly became a prominent performance band, touring during the summer with Dick Clark's "Caravan Of Stars" and backing up such acts as Del Shannon and Gene Pitney. (Bruce, the youngest brother was only 13 at the time.) While performing with the Dick Clark tours, they decided to change the name of the group. They selected a name stemming from an early Scottish ancestor, the legendary stagecoach robber and clan leader, Rob Roy. They became "The Robbs." They recorded their first single with Chess/Argo and later were signed successively with with RCA, Mercury, Atlantic and finally ABC/Dunhill.

At Chess Studios in Chicago they were initiated into the technical side of recording. Recording equipment, in that era consisted of two track machines. Professional engineers and producers were unheard of. (A&R men performed these functions.) Dee was forced into service. "I began by helping out and soon found myself twiddling

knobs." The Robbs were the first band to carry their own sound and lighting equipment on tour; all this was hand constructed from components scrounged at various studios.

Following the Dick Clark experience, the group began their own national tours, opening for the Dave Clark Five, Chad & Jeremy and Freddy and The Dreamers. In 1966 they were signed as Dick Clark's regulars on his TV show "Where The Action Is." They debuted with their song "Race With the Wind" which was released by Mercury and became their greatest hit.

"'Action' was fantasy," recalls Dee. "The novelty of filming was exciting but we missed the inspiration provided by audiences of thousands of frantic fans. The 'Action' shooting was all done on location and the spectators were limited by invitation. We did not fully grasp the fact that we were actually being watched by millions (which was probably just as well). After the first 14 shows were in the can, we went on a short tour. BLAM! We would pull into a town and find hundreds of screaming kids outside our hotel holding up 'Robbs' signs. We were young and we didn't expect this so, of course, we were dazed and unprepared. The total surprise of these receptions brought home to us the magnitude and power of national TV exposure. Fortunately, the experience gained in the early segments enabled us to handle the rest of the run of the show. Then, after the first year, the show went off the air and it was all gone before we had a chance to figure out what happened."

"It is a source of amazement to us that no one seems to be aware that 'Action' was years ahead of the market. It was in reality, the forerunner of the current Rock-video format."

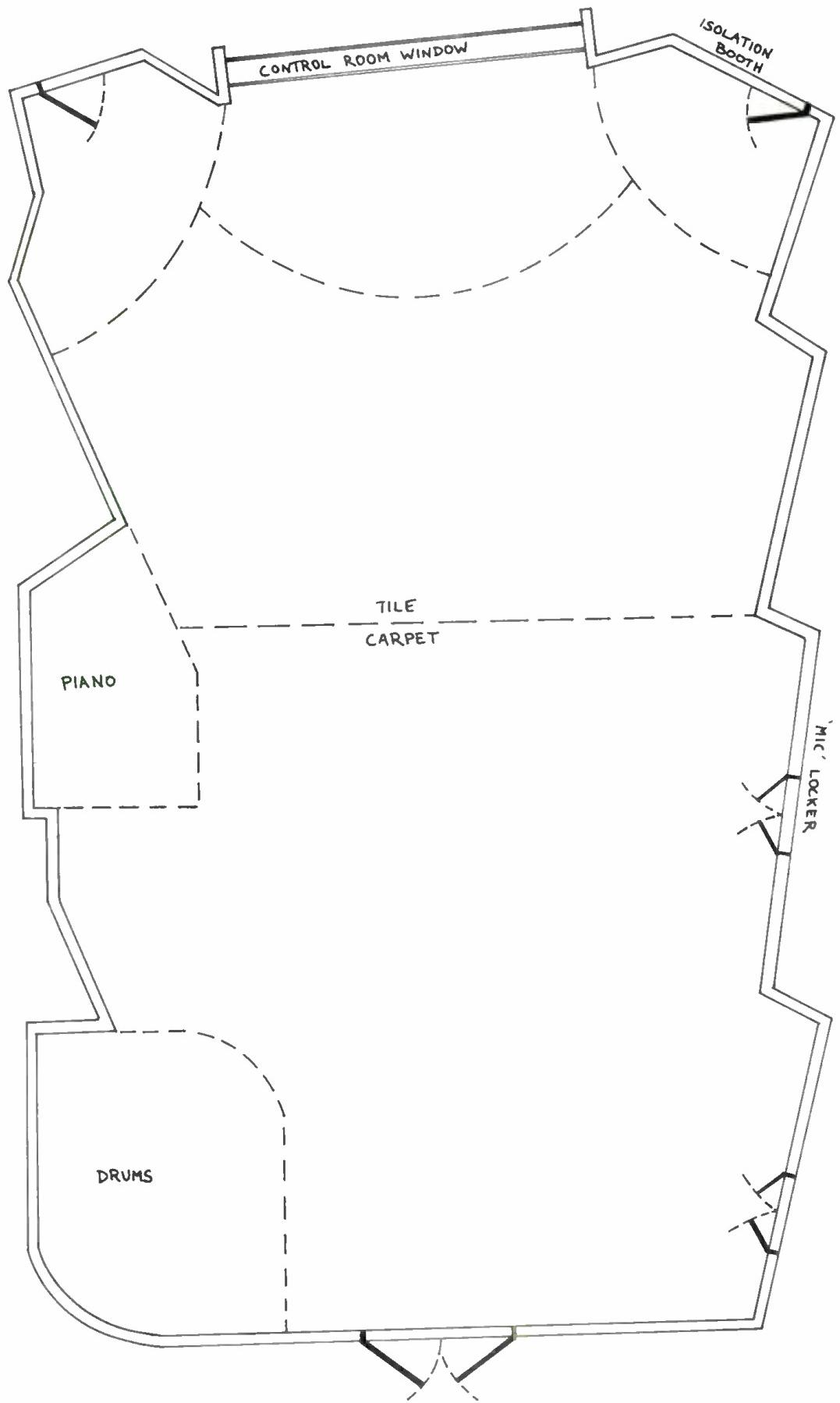
In 1967 they moved to California permanently, settling on a ranch in Chatsworth. Two years later their father phoned. "Hey, I just sold my business." "What are you going to do now?" he was asked. "I haven't the faintest idea," he responded. The next day he was in California adapting to the unconventional Robb lifestyle.

Under contract to ABC/Dunhill, the band changed its name to "Cherokee" and christened ABC's new one room studio. Soon thereafter, the record company instituted a new policy that had a profound and unexpected effect on the Robbs' future. The label eliminated all demo budgets, insisting that all their contract artists record in the ABC studio. The room was immediately booked a year in advance by the power groups, Three Dog Night and Steppenwolf. Cherokee was the pitiful orphan. "They can't do this to us," they fearlessly cried, "we will build our own demo studio."

"We consider ourselves audiophiles but not fantasies. If it sounds right and is functional we don't care what the book says. We visually minimize the technical. We try to not make it so overwhelming and intimidating. The idea is to make it easy to make records. We don't believe that if you're not suffering it's not art. When we started, all the studios were owned by technicians and historically a good portion of the equipment was designed by people who never used it. They didn't sit down and make records. We designed the studio for ourselves, functionally, for artists."

Their equipment is only part of the story. What they do with it means even more.

"We're known for building, designing and innovating our own equipment. In 1976, the industry was intimidated by the hand-built, British-made Trident Audio console because they had no technical representatives in the



United States. We went out on a limb and bought it—because it was the finest in the world. We were the first to have their top-of-the-line model on the continent. There are only 13 in the world and we have four of them. They don't build them anymore. Now we know more about the Trident, a range console, than the manufacturer, since we've modified them so much over the years. We set the standard."

They also innovated the use of independent engineers. In the beginning, nearly all engineers worked for studios. Cherokee has never had any staff engineers. Soon the entire industry followed their lead. As for the artists, they enjoyed Cherokee's forward-thinking attitude.

"We remembered what would happen to us when we were an act. We'd walk in a studio all pumped up and there'd be some old engineer who'd say, 'Rock 'n' roll's just noise.' They felt pop music was vulgar. We were just the opposite. Our attitude is you treat people here as if they're guests at a party in your home. Our clients are always amazed how nothing seems to break down here. Of course things break down. They just don't know about it. We don't jump up and down pulling our hair. If something breaks, we plug in a new one. We try never to break the creative flow."

During the recession, rather than buying new equipment, they expanded their technical staff to keep what they had in top flight condition. Advises Dee, "When you have something good, don't mess with it."

But times are a-changin', he adds. "Now we're expanding, not cutting back. It's a whole new ballgame. Records are made for a quarter or third of what they were before and for a while that affected quality. Now there's a turnaround. People feel they can bring an album in on budget and not compromise the sound quality."

They've done more technical updating in the last year than in all the previous years combined, spending nearly \$400,000 last year for new equipment.

Seeing the future of the music business moving ever closer to television and film, all their studios are now able to be used for scoring. After investing in complete video synching equipment, they can claim soundtracks from *Saturday Night Fever* to the *Fame* television series to recent films such as *Where The Boys Are*, *Body Rock*, *The Little Drummer Girl*, *Sgt. Pepper*, *The Idol Maker*, and *The Jazz Singer*.

EXTRANEous REWARDS

But the recording business, after all is said and done, is more than just dollar-and-cents. One day at Cherokee, for example, David Bowie discovered that Frank Sinatra was recording in an adjoining studio. He sent him a note of admiration and invited him to dinner. The Chairman of the Board returned the kudos and accepted. In few other businesses is such magic possible.

"There's not a day that goes by that some idol of mine isn't sitting in my office, depending on me, complimenting the studio," Dee says proudly. "The music business is definitely not like selling shoes. It's more serious—and more fun too."

CONSOLE CONVERSION

At the present time Toby Foster, director of engineering, is in the process of virtually rebuilding, from the ground up, four new consoles, based on the Trident A range console. Cherokee was faced with the need to upgrade and improve their equipment and since their prime concern was sonic integrity and a straightforward

approach, they chose to work around the present Trident consoles.

"We got our first Trident A range at the 1976 AES show and began to modify it almost immediately," says Robb. "We wanted to change, among other things, the cue system, the way the solo system worked and the fact that there was no stereo buss. We loved the sound of the board, but felt we could improve on the design," he added.

Foster said: "There are many things on a console that are used only 5% of the time but they may be an obstacle 90% of the time. If you can get the same results from just a patch cord instead of all the bells and whistles, then you should do it."

The reason for gutting, redesigning and rewiring an existing console chassis was, that "we couldn't find anything out there that was just right for us," says Foster. "Manufacturers are only now recognizing the need for something more fully automated as say, a NECAM, but with a more straightforward approach."

According to Foster and Robb it's simply too expensive for console manufacturers to build a board with the kind of circuitry and design that goes into Cherokee's custom console. "For us, on the other hand," says Robb, "it's cost-effective to use the best components we can get."

EQUIPMENT

Cherokee's equipment list is long and bountiful. In three of the four studio control rooms, the studio has the modified Trident A range consoles. One of these rooms is also equipped with a NECAM automation system. The fourth room is an electronic music recording and overdub room equipped with an Amek console. All the monitoring at Cherokee is customized. According to Foster, "We spend more time, effort, and money on monitor systems than 'anything else.' Annual maintenance costs for the monitor system alone is nearly \$10,000. The studio utilizes Hafler and BGW power amps and every tape machine (multitrack, $\frac{1}{2}$ -in., and $\frac{1}{4}$ -in.) in the studio is an Otari. Cassette machines are Aiwa. Cherokee has the usual assortment of state-of-the-art outboard gear, as well as a lot of vintage tube equipment that is very popular.

STUDIO SERVICES

Cherokee Recording Studios also houses the "CHEROKEE TECHNICAL SERVICES," a division of the company which offers a wide range of studio services to the Southern California recording community. A full team of technical experts and specialists are on call around the clock; seven days a week.

Cherokee will provide a fully equipped, state-of-the-art, diagnostic laboratory for immediate response to any studio problem "from a broken microphone cord to remedial computer analysis for the most sophisticated recording systems," says Cherokee principal Dee Robb. "We are also going to feature a preventative maintenance program, tailored to meet any and all needs of each individual operation as well as systems design, carpentry, studio design and, even, custom studio furniture." Robb added.

This service will be reasonably priced with a rate schedule based on a sliding scale depending on frequency of service calls and the degree of technical expertise required.

The Cherokee Recording Studio is located at 751 North Fairfax Ave., Hollywood, California. For information please call Con Merten at 213-653-3412.

New Products



ELECTRO-VOICE SUBWOOFER

- In the TL tradition of tight clean bass in packages of modest size, EV's new TL3512 subwoofer provides high-output reproduction of very low frequencies. Ideal for permanently installed sound reinforcement and music playback systems, the TL3512 may be used in a wide variety of venues including cinemas, auditoriums, theaters, performing arts centers, nightclubs and concert halls. Based on the vented enclosure modeling techniques of A.N. Thiele and R.H. Small, the TL3512 combines high efficiency and sensitivity (99 dB, 1 W/1 M) with low distortion and extended low-frequency performance in a nine-cubic-foot enclosure. By covering one port and applying ap-

propriate boost-and-cut equalization, the low-frequency limit can be "stepped down" from the normal 38 Hz (3 dB down) to 28 Hz, a useful extension for many applications. The TL3512 employs a DL18W very low frequency reproducer. The woofer's high linear cone-excursion ability and 400 watt long term average power capacity (EIA Standard RS-426A) contribute to the TL3512's high acoustic output ability. The TL3512 is constructed of black, vinyl clad, $\frac{3}{4}$ -inch particle board and equipped with a sturdy metal grille screen.

Mfr: Electro-Voice Inc.

Price: \$670.

Circle 26 on Reader Service Card

PANASONIC FFT ANALYZER

- A powerful FFT-based spectrum analyzer is now available from the Instrumentation Department/ACD of the Panasonic Industrial Company. Designated as the "VS-3310P OPT.09," the instrument is ideal for solving a variety of problems in the 0 Hz (DC)-40 kHz range. It features low noise floor, high resolution, pre- and post-triggering of transients, and external sampling, which is useful in such fields as acoustics, geophysics, and sonics. The built-in intelligence of the VS-3310P can be used for go/no-go testing, as well for providing a quick, completely annotated hardcopy at the push of a button (with an optional, factory-installed, video printer). In addition to its wide (DC to 40 kHz) frequency band, the VS-3310P also offers a 3-dimensional display function, particularly useful for audio and acoustic analyses. Standard memory is 64 k-word, expandable to 128 k-word. A portion of the memory can be used for superimposing vibration spectra as 3-dimensional display. Other specifications include: input range of -30 to 30 dB; impedance of about 1 megohm; resolution: time data—1024/512 points, frequency data—400/200 points; a/d conversion



at 12 bits; zooming—2 to 32; averaging—sum, exponential, or peak hold; display—8-in. CRT, raster scanning; arithmetic capability—four basic operations comparison, differentiation/integration; analysis functions—waveform observation, amplitude spectrum, power spectrum, octave

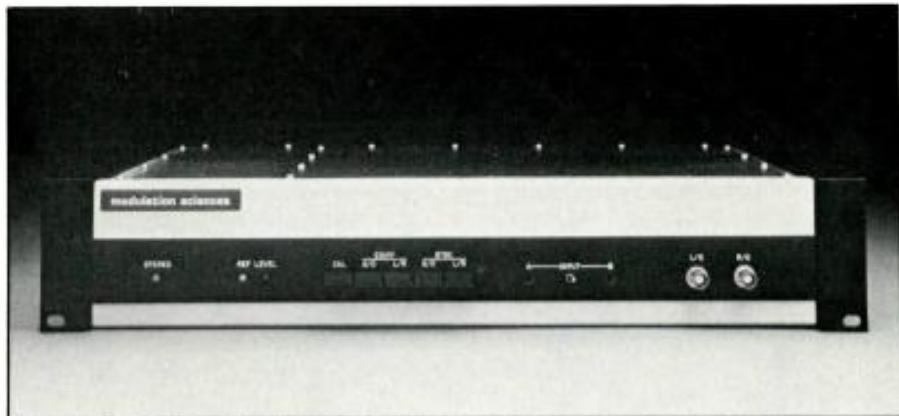
and $\frac{1}{3}$ octave filter, probability histogram, inverse FFT, and auto-correlation.

Mfr: Panasonic Industrial Company
Price: \$6,850 without printer,
\$8,100 with printer.

Circle 27 on Reader Service Card

MODULATION SCIENCES' STEREO REFERENCE DECODER

• Modulation Sciences' new precision Stereo Reference Decoder (SRD) closes the loop on MTS Stereo set-up, calibration and off-air monitoring for television broadcasters. SRD enables broadcasters to accurately calibrate their TV stereo generators to BTSC standards. Designed to be a primary transfer standard, it will verify the performance of any stereo generator including the Modulation Sciences model TSG (now on-air in more than a dozen stations). The SRD permits a fast, easy set-up and has also been designed to work with the new MTS-modified Tektronix 1450 wideband demodulator (and others like the Hewlett Packard 8901A).



Other features include contact closure for remote stereo status indication, useable with multiple sources without time consuming recalibrations. Stereo separation specifications: greater than 50 dB in equivalent

mode; greater than 40 dB in BTSC mode at all modulation levels.

Mfr: Modulation Sciences

Price: \$4,750.

Circle 28 on Reader Service Card

PENNY & GILES MOTORIZED FADER

• Penny & Giles has developed and now has available a new motorized studio fader to enable console manufacturers to incorporate moving fader automated re-mix at a reasonable cost and without degradation of the operating feel of the faders. The dimensions of the fader have been minimized to permit mounting within a channel width of less than 25 millimeters and the slider travel of 104mm is compatible with Penny & Giles' existing range of manually operated faders. Touch sensing circuitry is incorporated within the fader, and provides a CMOS logic compatible output when the slider



button is touched by the operator. Full scale travel can be achieved in less than 100 milliseconds to ensure

faithful reproduction of pre-programmed fader operations. The fader can incorporate mono or stereo audio taper potentiometer elements in addition to the linear position control element.

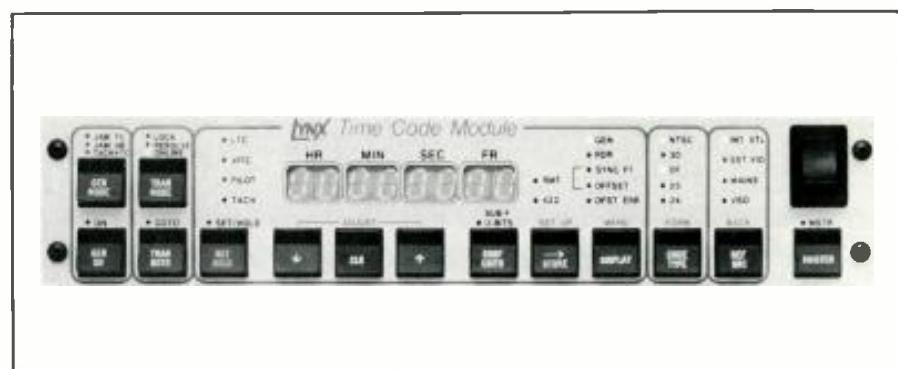
Mfr: Penny & Giles Conductive Plastics Ltd.

*Price: \$245. for basic mono fader.
\$270. for basic stereo fader.
Add 20. for touch sensitivity option.*

Circle 29 on Reader Service Card

TIMELINE TIMECODE MODULE

• A new concept in SMPTE time-code equipment, the TimeLine LYNX timecode module incorporates the three elements of a complete time-code system in a single half rack enclosure. Each LYNX module contains an independent time code generator, a wide band timecode reader (to 60x speed), and a transport synchronizer with built in parallel interface. To function as a high performance chase synchronizing system, one module is connected to each controlled transport. Up to 32 modules/transport can be on line simultaneously. The system features the unusual ability to freely select any machine as the current time-code "master," and to take machines on and off line without regard to



hierarchy. Also featured is an RS422 serial port for external computer control, and for interconnecting to the forthcoming LYNX timecode controller. The LYNX system is compatible with all worldwide time-code standards, and comes complete

with self contained power supply which operates from 100-250 VAC, 50/60 Hz.

Mfr: TimeLine

Price: \$2,450.

Circle 30 on Reader Service Card

NEW STUDER CD PLAYER

• The Studer A725 Professional CD Player is designed for a wide range of applications, including broadcast production and on-air playback. Special control software provides multiple disc cueing modes as well as exceptional cueing accuracy. Start accuracy is ± 1 frame (13.3 ms) and start from pause takes less than 0.6 second. Large buttons and a clear front panel layout minimize the chance of operator error. The A725 has three pairs of stereo outputs: balanced professional line level, unbalanced with adjustable level, and unbalanced with fixed level. The four mode display is easily switched to show disc time elapsed, disc time remaining, track time elapsed, or track time remaining. When available and accessed, disc indexes are also shown. A bar graph indication provides additional information on track remaining or approximate elapsed track time, depending on display mode selected. Operating features such as pause, skip, repeat, loop and autostop may be pre-programmed while a disc is playing.



Mixed combinations of times and track numbers may be used as programming step boundaries, and up to 19 steps may be programmed at one time. A cover is provided to discourage unauthorized use of the programming control section, located on the lower left side of the front panel. Other professional features of the A725 include rack mount flange and a die-cast disc transport chassis for long-term stability and durability.

A serial data port is provided for external computer control. The A725 is sonically identical to the consumer-oriented Revox B225 CD player. Both units utilize the same oversampling (176.4 Hz) and digital filtering along with proprietary analog filtering circuits.

Mfr: Studer Revox America Inc.

Price: \$1,550.

Circle 31 on Reader Service Card

TEKTRONIX AUDIO TEST AUTOMATION SYSTEM

• Audio equipment professionals can now automate manual test procedures without a long and costly development period. Tektronix has packaged a complete solution for many audio tests that includes a test program generation tool, as well as stimulus, measurement and control capabilities. The MP 2902 Audio Measurement Package provides a means of developing customized system software in a minimal time without programming knowledge. Audio designers and manufacturers immediately realize the benefits of automation—more consistent, thorough test procedures, high throughput, lower operator skill requirements, complete documentation, and improved product reliability—without absorbing the cost of hiring programmers or training audio technicians to write test programs. MP 2902 hardware includes an AA55001 Programmable Distortion Analyzer, a SG5010 Programmable 160 kHz Oscillator, a TM5006 Power Mainframe; a 4041 Instrument Controller and a 4105 Color Graphics Display. In addition to the test program generation (TPG) software, the 4041



controller software includes packages for graphics, plotting and utility functions. Eleven of the most common audio tests are predefined by the TPG's interactive menus including signal-to-noise, frequency response, THD (total harmonic distortion) versus frequency, THD versus output level and maximum undistorted output level. Audio engineers or technicians create a test program by

interacting with TPG menus while stepping through a normal test procedure. The TPG determines the proper settings for the AA5001 Distortion Analyzer and SG5010 Oscillator in order to properly execute the test.

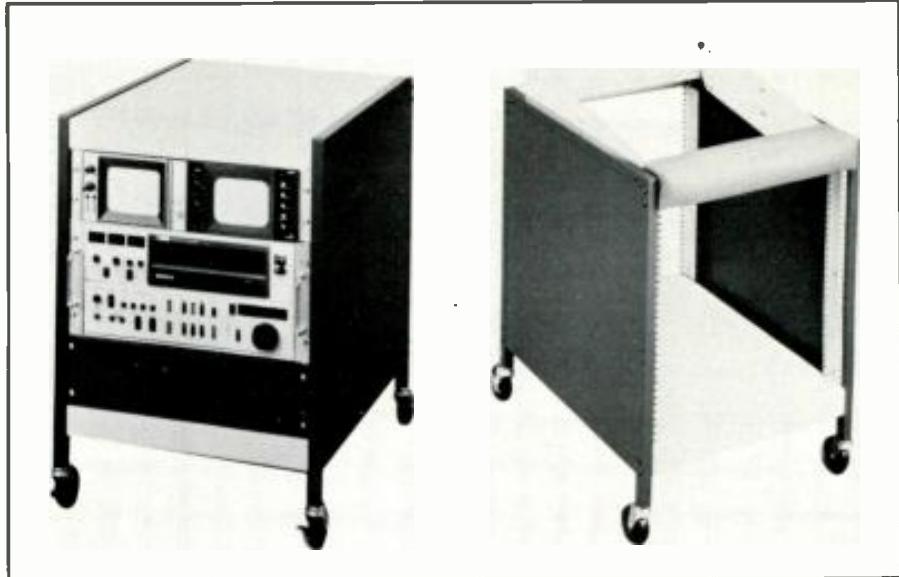
Mfr: Tektronix Inc.

Price: \$23,365.

Circle 32 on Reader Service Card

MOBILE EQUIPMENT CART

- The Mobile Equipment Cart Model G8706 is an affordable roll-up cart for studio or mobile use. Designed with two shelves and four removable 19½-inch rack rails, the cart features a two position bottom shelf which can be fixed at center height for compact electronics. The cart rolls easily on 3-in. casters (two locking) and features strong heavy duty steel construction with beige and gray enamel finish. The Mobile Audio/Test Cart (Model G8708) provides a convenient roll around electronics support system for equipment used in several locations. Top rack has 19½-in. of rack space, can be used flat or tilted 10 degrees for operator comfort (shown with optional comfort pad). Two position shelf adjusts to fit your electronics. End panels provide 19½-in. of rack space to accommodate more rack mountable equipment. Heavy gauge steel construction with



beige and gray enamel finish. Three inch swivel casters for easy mobility.

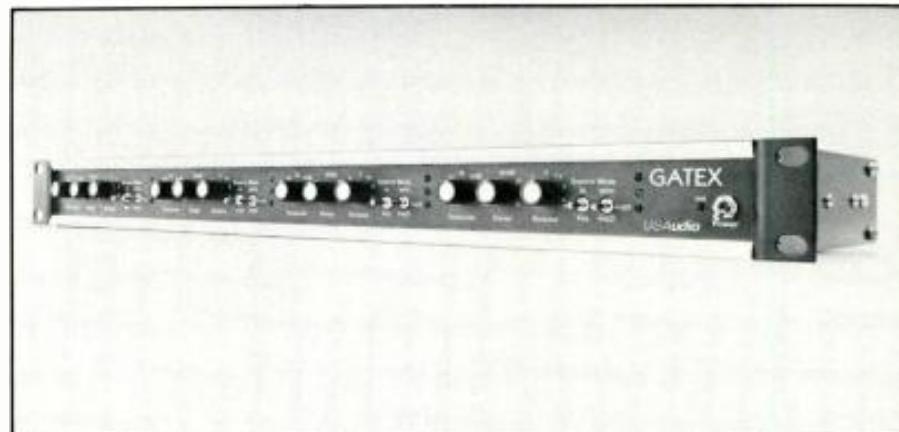
Mfr: The Winsted Corp.

Price: G8706, \$237.
G8708, \$259.

Circle 33 on Reader Service Card

USAUDIO GATEX

- USAudio has studied the need for noise gates and expanders, and found an innovative way to offer technology that is both effective and readily understood. The result is a new four channel noise gate/expander unit that affords the user intuitive application with the support of solid circuit design. At the heart of Gatex is the new Valley People TA-104 Voltage Controlled Amplifier. By virtue of its distortion free operation and wide dynamic range, the TA-104 allows Gatex to process audio signals without coloration. Feed-forward control circuitry allows accurate gain control without instability caused by control lag commonly found in less expensive processors. And DC control of all functions eliminates Noisy Pot problems because no audio signals pass through the front panel controls. All user controlled parameters are optimized for ease in set-up and operation. The unit's variable threshold encompasses the range of levels from -40 dB to +20 dB, providing the versatility to process all types of program material. A complementary range control enables the user to adjust the amount of maximum attenuation from subtle



noise reduction to an 80 dB Cut-off, thus allowing dynamic control not achievable with less sophisticated devices. Even the release control is special. Program Controlled Sustain automatically lengthens the release time as dictated by the program content. So, desirably short release times may be employed without creation of unwanted distortion. The Gatex mode select switch permits the unit to perform hard noise gating, 1:2 expansion, or unobtrusive noise reduction. In all modes, Turn-On noise is eliminated by means of Program Controlled Attack, which alters attack time according to the

demands of the material being processed. Keying is made possible via the Gatex source switch. In this mode, an external signal may trigger the gating or expanding action of the device. An easy-to-read three LED display allows the operator to monitor the operation of Gatex at a glance. The green LED indicates a Full-On or unity gain condition. Yellow provides visual indication of ongoing expansion, while red shows maximum attenuation as determined by the range control.

Mfr: USAudio, Inc.

Circle 34 on Reader Service Card

• Michael Moon has joined **Crown International, Inc.**, a leading manufacturer of audio electronics and microphones, as information services manager. In his newly created position, Moon will be responsible for directing the electronic data processing systems and programming activities, including systems design programming of procedures, and operation of computer and tabulating equipment. It will also involve co-ordinating the integration of present office operation, manufacturing data operations and data processing into electronic or automatic data processing. Moon came to Crown from the Salem Bank in Goshen, Indiana, where he was the vice president of Data Processing for six years. Before assuming that position he was the assistant vice president of Data Processing at the Bank of Alma in Alma, Michigan.

• Steve Bramberg has been appointed studio manager of Bearsville Studios near Woodstock, NY. Bramberg's duties will include supervising the studios and rehearsal barn facilities daily operations, handling all booking and production arrangements, and overseeing all aspects of new equipment selection. Bramberg most recently was vice president and general manager of Boogie Hotel Studios since its opening in 1981 and before that, has managed other studios such as Media Sound, Electric Lady and Kingdom Sound.

• Jim Holt has been named director of marketing for **Electro-Voice, Inc.**, a supplier of high technology mics, speakers and electronics to professional and consumer markets worldwide. Holt is now responsible for tactical marketing efforts in EV's music, professional pro sound reinforcement and commercial business sectors. Holt comes to Electro-Voice from American Sterilizer, a major manufacturer of hospital equipment and furniture, where he was marketing director of the Unicell Division. Prior to that, Holt was associated with the Harter Corporation and has worked in the professional dental and biomedical electronics industries.

• Barrie Hozier has been appointed general manager of **Soundcraft Electronics** while retaining his previous role of financial director. Formerly group chief accountant with Pickfords Removals for five years, he is a Chartered Accountant by profession. John Child has recently joined Soundcraft Electronics as manufacturing manager and is responsible for the efficient running of the new factory which includes total involvement in all technical and administrative aspects of manufacturing. Also, Claire Finch has been promoted to marketing coordinator following the departure of Kate Charters. Her responsibilities now include coordinating exhibitions, PR, and advertising, in addition to liaising with Soundcraft's UK and overseas distributors.

• Hitachi America, Ltd. a wholly owned subsidiary of Hitachi, Ltd., of Tokyo, announced the appointment of Tsueno Tanaka as president of Hitachi America, Ltd. Mr. Tanaka was the general manager of the International Sales Division I of Hitachi, Ltd. prior to his new position.

• Proton Corporation, manufacturers of high-end audio and video products, have made several management changes. Jay Eagle, Proton's executive vice president and spokesperson since April 1983, has accepted a position with another company. Lee Brady, national sales manager, will act as company spokesperson, and a new addition to Proton, David Lin, will serve as special assistant to the president. Ed Strand is the new national service and technical manager, responsible for Proton's service department and centers.

• Steve Shafer has been appointed as national sales manager of Proton Corp., manufacturer of high-end audio and video products. Prior to joining Proton, Shafer was the national sales manager for Sanyo's consumer electronics division. Shafer now plans to give particular attention to Proton sales strategy, including reviewing the company's US distribution patterns.



Valley Audio/Discrete Research Joint Venture

• Bob Todrank, President of Valley Audio, Nashville, TN, and Neil Grant, Technical Director of Discrete Research, LTD, London, announced their association which was formed to jointly pursue mutual interests in the areas of Audio/Video facility design and consultation work. Discrete Research, LTD is actively involved in the design of acoustical spaces, including audio recording studios and production rooms. Some recent projects include: the design and rebuilding of a remix room for Eutopia Studio; the design and construction of a remix room for Odysey Studio; rebuilding of Odysey's Control Room 1 and Studio 1; and the design and construction of Swan Yard Studio. They will bring their acoustical expertise and monitor systems into the association. Valley Audio is a 13-year old company dedicated to professional audio system design and "turn-key" facilities, including recording studios, mobile trucks, broadcast studios, and video production facilities. At this point there are no plans for an additional company name since the association will develop and function as an extension of both individual firms. Both organizations plan to work jointly on large scale projects, monitoring systems, and "turn-key" facilities, while continuing their individual pursuits.

SPARS Database

• SPARS (The Society of Professional Audio Recording Studios) recently announced a grant from the 3M Corporation to establish a studio industry market statistical database. SPARS will survey manufacturers and all types of production studios to determine what data will be usable, valuable and obtainable. From the results of this study, a questionnaire will be constructed and sent to over 5,000 audio and video production facilities. The data obtained from the questionnaire will be published in an annual slated for release in February of 1986. SPARS plans to include studio listings as a major part of the annual; listing such information as brands of equipment, size of rooms, etc. Also included in the annual will be analysis of data regarding rate trends, purchasing trends, and other information useful to both manufacturers and studio owners. SPARS plans also call for installing the studio listing portion of the database as a service on the IMC Computer Network. According to Gary Helmers, SPARS Executive Director, one of the primary purposes of the database will be to provide studios with information they need in structuring financing, planning expansion and developing business plans.

Northeastern Addition

• Northeastern Digital Recording of

Shrewsbury, MA, received shipment of a new Sony DAE-1100 Digital Audio Editor. NDR is the only facility in New England that does professional digital recording, editing and mastering for compact disc. Recent sessions include: Digital mixdowns to the PCM-1610 of two songs by Dance Music. (The songs were recorded at Long View Farm and produced by Bob Swanson and Toby Mountain); digital editing and mastering of two compact disc releases by Titanic Records of Cambridge, MA; digital editing and mastering of a new album release produced by Boston jazzman, Richard Hollyday, and engineered by Bob Reardon of Air Sound; a live PCM-1610 digital recording of keyboardist, Paul Gillman, at symphony hall in Boston, in conjunction with Le Studio's remote truck.

RCA Installs Soundstream's Digital Editing System

• RCA Record's new state-of-the-art digital editing system is in full operation in a specially designed suite at RCA's NY studios. The system, designed and manufactured by Utah based Soundstream, Inc., is the only one of its kind located in the US. RCA's acquisition of the editing hardware and software is unique in that this is the first time the manufacturer has licensed the use of its software to a record company.

Classified

FOR SALE

FOR SALE: WESTREX 3DIH, \$4,400; Haeco SC-2, \$6,000; Haeco SC-1, \$1,700; Grampian D, \$325; Westrex 2B, \$400. Haeco cutterheads new, other cutterheads rebuilt and within specifications. New solid state amplifiers available. **International Cutterhead, 194 Kings Court, Teaneck, NJ 07666. (201) 833-4421.**

NEW! Infrared Wireless headphones. Improved for greater sound pressure—available soon! Write for spec sheet—**Windrose, P.B.O. 1078A, Vineland, NJ 08360.**

THE MOST COMPLETE
SELECTION OF

AUDIO TEST TAPES

All formats including cassettes
Write or phone for free catalog



STANDARD TAPE LABORATORY, INC.
26120 Eden Landing Road #5, Hayward, CA 94545
(415) 786-3546

FREE 32pg Catalog & 50 Audio/Video Applic.

PWR SUPP. ED.
PHONO, MIC.
TONE, ACN.
TAPE, VIDEO,
LINE, OSC

Video & Audio Dist. Amps. 8-in./2-out, 12-in./4-out, 16-in./4-out
OPAMP LABS INC (213) 934-3566
1033 N Sycamore Av LOS ANGELES CA, 90038

PROFESSIONAL Audio Equipment (used). Mics, Synthesizers, Vocoder, Tape Rec., etc., etc. Call (212) 595-7822 Weekdays 3-7 pm.

Crown Microtech, Nakamichi, Electro-Voice, professional services; BEST PRICES. AmeriSound Sales, Inc., east coast: (904) 262-4000; west coast: (818) 243-1168.

EQUIPMENT FOR SALE: NEOTEK Series III; 28x24 with 16 Busses, 6 echo returns custom "pre-return" submaster fader, extra patch bay, producer's desk, leg set, patch cords, spare parts, excellent condition; \$25K. WHITE 32-band EQ's \$550 ea. E-V Sentry III's \$600. (312) 864-4460.

Interface monitor console with parametric equipment module 24 x 12 \$5500 including road case. 32 channel Yamaha PM 1000 console \$5500 including road case. 15 each Altec 291 drivers with diaphragms \$175 each. 6 each Altec 511E horns with EV DH 1012 drivers \$225 each. (512) 441-1631.

Closing date is the fifteenth of the second month preceding the date of issue.

Rates are \$1.00 per word with \$25.00 minimum. Boxed ads are \$40.00 per column inch. db Box Numbers are \$8.50 for wording "Dept. xx" plus \$1.50 for postage and handling.

Discounts: 6x—15%, 12x—30%.

**ALL CLASSIFIEDS
MUST BE PREPAID.**

Send copies to:
**db The Sound
Engineering Magazine
1120 Old Country Rd.
Plainview, NY 11803
att: Classified Dept.**

EMPLOYMENT

WANTED

Full Time **INSTRUCTORS** Part Time

FOR
AUDIO TECHNOLOGY
and/or
VIDEO TECHNOLOGY
and/or
DIGITAL TECHNOLOGY
and/or
GENERAL ELECTRONICS TECHNOLOGY

Career positions immediately available in teaching and preparation of practical curricula for the dynamic, professional recording industry. Work in a congenial, professionally satisfying atmosphere.

Location—historic Greenwich Village.

Salary—attractive; commensurate with background, experience and responsibility of position.

Send detailed resume, including salary history to:

Philip Stein, Director
Institute of Audio Research
64 University Place
Greenwich Village
New York, N.Y. 10003



SERVICES

CUTTERHEAD REPAIR SERVICE for Westrex, Haeco and Grampian. Convert your old Westrex to model 3DIIH. New and rebuilt cutterheads available. International Cutterhead, 194 Kings Court, Teaneck, NJ 07666. (201) 833-4421.

MOVING?

Keep **db** coming without interruption!

Send in your new address *promptly*.

Enclose your old **db** mailing label, too.

Write to:

Eloise Beach, Circ. Mgr.
db Magazine
1120 Old Country Rd.
Plainview, N.Y. 11803

New York Technical Support, Ltd

IS SERVICE

"We provide the support necessary for today's recording technology. Our work is guaranteed."

CALL
GREG HANKS
914-776-2112

1440 MIDLAND AVE. SUITE-1D
BRONXVILLE, NY 10708

HAVE A RECORDING STUDIO PROBLEM?

Call DataLine
(213) 651-4944

The Society of Professional Audio Recording Studios, a non-profit organization, offers SPARS members, and non-members referred by a SPARS member, a national telephone 'hot-line.'

Questions regarding any area of recording studio operations including business practices, audio engineering, and technical maintenance will be answered by SPARS-approved sources at no charge.

Want a problem solved?...call SPARS—**(213) 651-4944**

Have you misplaced your **db** again? Our high quality, royal blue vinyl binders keep 12 copies of **db** neat and handy for ready reference.

Just \$9.95, available in North America only. (Payable in U.S. currency drawn on U.S. banks.) ORDER YOURS NOW!!

Sagamore Publishing Co., Inc.
1120 Old Country Road
Plainview, NY 11803

YES! Please send _____ **db** binders @ \$9.95 each, plus applicable sales tax. Total amount enclosed \$_____

Name _____

Company _____

Address _____

City _____

State/Zip _____



If you're reaching for Gold or Platinum, first reach for **AGFA PEM 469**

Because there's never been a mastering tape like it. Agfa PEM 469 captures your sound perfectly in its complete dynamic range. It's everything you've always wanted. Reach...and you'll succeed...with Agfa PEM 469. The only thing standard is the bias.

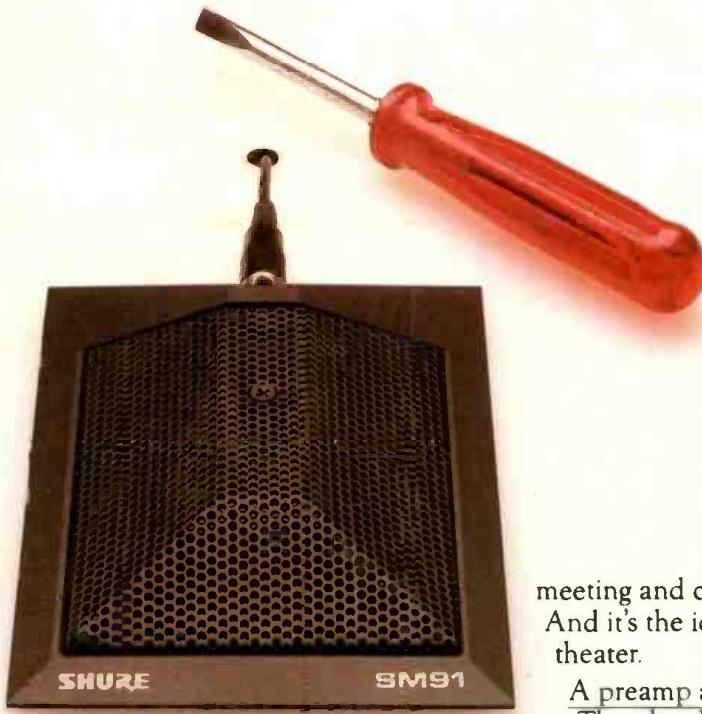
AGFA
AUDIO

AGFA-GEVAERT  275 NORTH STREET, TETERBORO, N.J. 07608 (201) 288-4100

Circle 11 on Reader Service Card

The world's first unidirectional surface- mounted condenser mic.

Clean and simple.



No carpet strips or plastic baffles needed. Until now, all surface-mounted mics have been omnidirectional. Trying to add directionality has required a lot of busy work. The new SM91 brings the big advantages of unidirectionality to boundary effect microphones by incorporating a condenser cartridge with a half-cardioid pattern that isolates the speaker from surrounding noises.

The new smoothie. The sleek SM91 delivers wide-band, smooth response throughout the audio spectrum, while greatly reducing the problems of feedback, low-frequency noise and phase cancellation. Ideal for instruments or vocals. The SM91 does a great job of isolating a vocalist or instrument in musical applications. It's also an excellent mic for

meeting and conference rooms. And it's the ideal mic for live theater.

A preamp ahead of its time. The ultra-low noise preamplifier provides switch-selectable flat or low-cut response, excellent signal-to-noise ratio and a high output clipping level. A low-frequency cutoff filter minimizes low-end rumble—especially on large surfaces. If you're going omni. Our new SM90 is identical in appearance to the SM91 and just as rugged.

For more information or a demonstration, call or write Shure Brothers, Inc.
222 Hartrey Ave.,
Evanston, IL 60204.
(312) 866-2553.

SHURE
THE SOUND OF THE PROFESSIONALS... WORLDWIDE